COMPUTING FOR BUSINESS AND HOME

INTERFACE AGE™

JULY 1982 $2.50/CANADA/MEXICO $3.00

NCC Highlights

Data Communications Revolution

Spreadsheet Programs Compared

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02651

THE PROWRITER COMETH.

(And It Cometh On Like Gangbusters.)

Evolution.

It's inevitable. An eternal verity.

Just when you think you've got it knocked, and you're resting on your laurels, somebody comes along and makes a dinosaur out of you.

Witness what happened to the Centronics printer when the Epson MX-80 came along in 1981.

And now, witness what's happening to the MX-80 as the ProWriter cometh to be the foremost printer of the decade.

SPEED

MX-80: 80 cps, for 46 full lines per minute throughput.
PROWRITER: 120 cps, for 63 full lines per minute throughput.

GRAPHICS

MX-80: Block graphics standard, fine for things like bar graphs.
PROWRITER: High-resolution graphics features, fine for bar graphs, smooth curves, thin lines, intricate details, etc.

PRINTING

MX-80: Dot matrix business quality.
PROWRITER: Dot matrix correspondence quality, with incremental printing capability standard.

FEED

MX-80: Tractor feed standard; optional friction-feed kit for about $75 extra.
PROWRITER: Both tractor and friction feed standard.

INTERFACE

MX-80: Parallel interface standard; optional serial interface for about $75 extra.
PROWRITER: Parallel and serial interface standard.

PRICE

Heh, heh.

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LEADING EDGE.™

CIRCLE INQUIRY NO. 59

New Cromemco System One shown with our high-capability terminal and printer.

A new small computer that won't limit you tomorrow

Here's a low-priced computer that won't run out of memory capacity or expandability halfway through your project.

Typically, computer usage tends to grow, requiring more capability, more memory, more storage. Without a lot of capability and expandability, your computer can be obsolete from the start.

The new System One is a real building-block machine. It has capability and expandability by the carload.

Look at these features:

- **Z80-A processor**
- **64K of RAM**
- **780K of disk storage**
- **CRT and printer interfaces**
- **Eight S-100 card slots, allowing expansion with**
  - **— color graphics**
  - **— additional memory**
  - **— additional interfaces for telecommunications, data acquisition, etc.**
- **Small size**

GENEROUS DISK STORAGE

The 780K of disk storage in the System One Model CS-1 is much greater than what is typically available in small computers. But here, too, you have a choice since a second version, Model CS-1H, has a 5'' Winchester drive that gives you **5 megabytes** of disk storage.

MULTI-USER, MULTI-TASKING CAPABILITY

Believe it or not, this new computer even offers multi-user capability when used with our advanced CROMIX* operating system option. Not only does this outstanding O/S support multiple users on this computer but does so with powerful features like multiple directories, file protection and record level lock. CROMIX lets you run multiple jobs as well.

In addition to our highly-acclaimed CROMIX, there is our CDOS*. This is an enhanced CP/M† type system designed for single-user applications. CP/M and a wealth of CP/M-compatible software are also available for the new System One through third-party vendors.

COLOR GRAPHICS/WORD PROCESSING

This small computer even gives you the option of outstanding high-resolution color graphics with our Model SDI interface and two-port RAM cards.

Then there's our tremendously wide range of Cromemco software including packages for word processing, business, and much more, all usable with the new System One.

ANTI-OBSOLESCENCE/LOW-PRICED

As you can see, the new One offers you a lot of performance. It's obviously designed with anti-obsolescence in mind.

What's more, it's priced at only $3,995. That's considerably less than many machines with much less capability. And it's not that much more than many machines that have little or nothing in the way of expandability.

Physically, the One is small — 7'' high. And it's all-metal in construction. It's only 14⅛'' wide, ideal for desk top use. A rack mount option is also available.

CONTACT YOUR REP NOW

Get all the details on this important building-block computer. Get in touch with your Cromemco rep now. He'll show you how the new System One can grow with your task.

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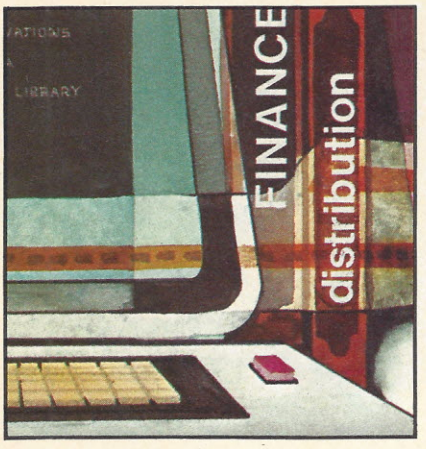
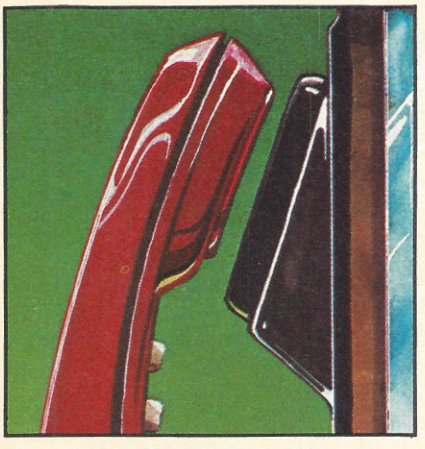
VOL. 8, ISSUE 7
SINCE DECEMBER 1975

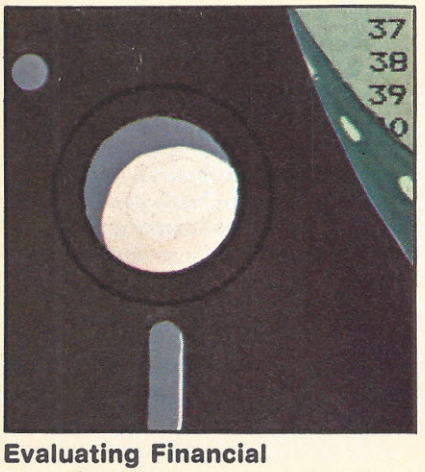
JULY 1982



Computerized Databases 66



Computer Communications via Telephone Line 70



Evaluating Financial Planning Packages 78

INTERFACE AGE™

COMPUTING FOR BUSINESS AND HOME APPLICATIONS

FEATURES

COLUMNS

DEPARTMENTS

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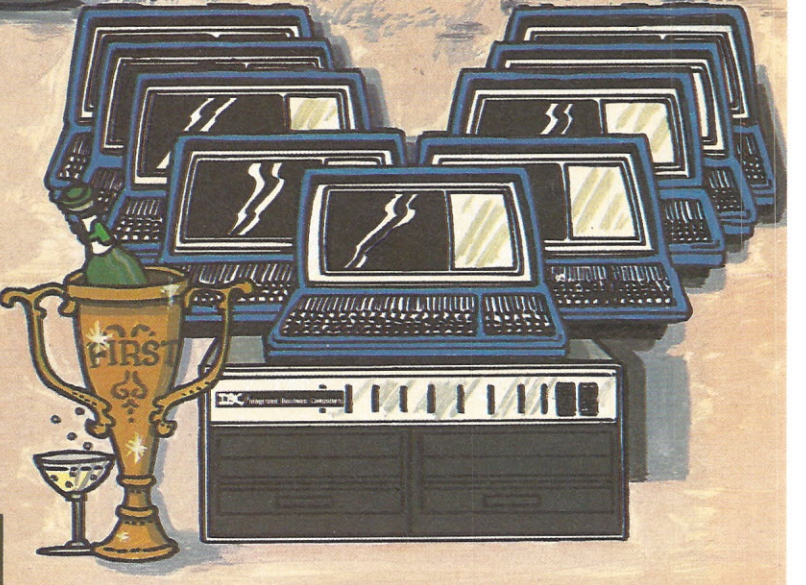
And The Winner Is...IBC By Four Users!

When you are racing toward that finish line, beating the competition is everything. IBC is the choice of OEM's, system integrators and dealers throughout the world, because in benchmark after benchmark our small business computer systems finish first.

We finish first because we are faster, offer higher quality peripherals and can expand our system significantly beyond our nearest competitors. In fact, looking at the chart below, you can quickly see why knowledgeable resellers are choosing IBC.



CIRCLE INQUIRY NO. 55

	IBC	onyx	ALTOS
Oasis Operating System (Max. Users)	9	5	4
CPU Speed (MHz)	6	4	4
Disk Speed I/O (MB/Sec.)	.81	.65	.54
Seek (Milli Sec.)	35	50	65
Cache Disk Memory	Yes	No	No

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OBSOLETE.

Now there is a filing system that automatically stores, retrieves and displays information typically kept in index card files—It's called CARDFILE™. CARDFILE stores notes, summaries of articles and books, recipes and menus, catalogs of records and tapes. It stores anything you might keep on file cards.

Entries are created using your own text-editor. They are automatically read into the index when you run CARDFILE. Each file record—the equivalent of an index card—can have up to 21 lines. CARDFILE treats the first three lines as "key" or "descriptor" lines that contain words or phrases to be searched for. (You can also search for a word or phrase in the remaining lines of text.)

To search the CARDFILE index, the user specifies one or several key words or phrases, depending on the desired breadth of the search. The program displays the full text of each record that contains all of the words specified. CARDFILE can also print selected records, write them to a disk file, or delete them.

If you're not using CARDFILE, your index card filing system is probably obsolete. **Price is $89.**

CARDFILE

THE NEW FILE CARD INDEX

CARDFILE requires CP/M 2.X and 48K RAM, or MP/M; and WordStar, Spellbinder, SuperWriter, Magic Wand or a similar text-editor. Formats: 8" IBM soft-sectored, North Star DD, Micropolis Mod II, Superbrain 3.0, Apple II with CP/M, 5¼" and 8" Xerox 820, and Osborne-1.

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EDITOR'S NOTEBOOK

Two on the move

Microcomputer manufacturers are as different as apples and anchovies. Some are giant corporations, established in unrelated industries. Others are shoestring operations yearning for acceptance. A few burst upon the scene with a fat catalog of coordinated products and an army of trained sales personnel. Others begin with a simple add-on product for existing systems.

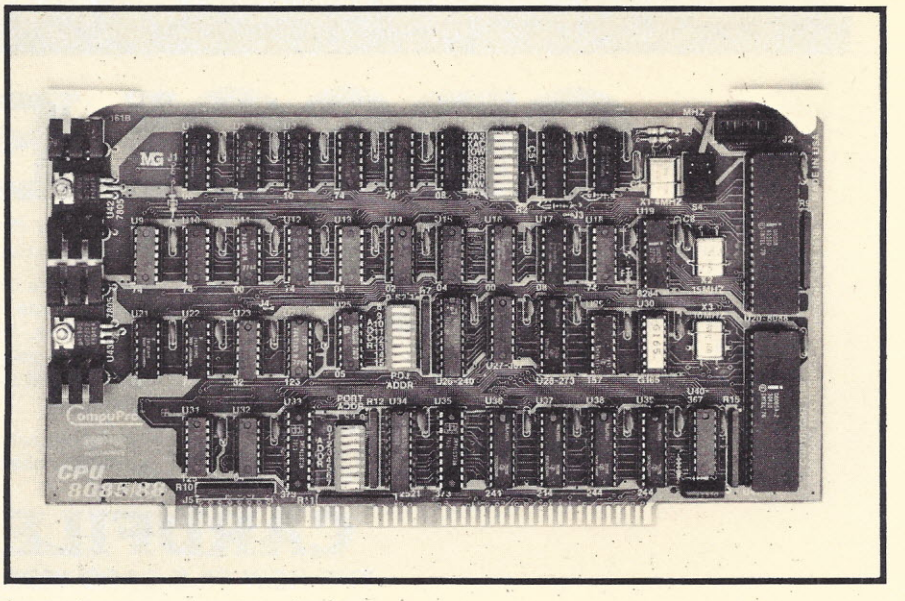
The last category is especially fascinating. Typically, a company begins by making one simple plug-in computer card; then adds another and another. Soon, computer stores are putting together whole computers out of parts in the company's catalog.

A surprising number of today's successful micro makers began life producing plug-in circuit boards for S-100 computers. A memory board is usually the first product, followed by input/output cards, disk controllers and other accessories. A board containing the central processor often follows, requiring that attention be given to software aspects of the product line.

From there, it seems a natural step to create a housing for all those boards, then to select a disk drive—perhaps even a terminal and printer. The company suddenly finds itself the creator of complete computer systems. New markets open up; customer support becomes a major consideration. Pressure soon mounts to supply applications software. This requires a kind of talent far removed from that needed to design and produce a simple memory board.

Many micro makers cut similar trails: Alpha Micro, Cromemco, Dynabyte, IMS Int'l, North Star, Polymorphic, Systems Group, TEI and Vector Graphic come to mind; but that's far from being a complete listing. Two more firms now ripening are Compupro and Corvus.

Compupro Systems (Oakland, CA) is a division of Godbout Electronics, one of the last holdouts from the kit days of our infant industry. Some Compupro people stopped by recently to show off their wares; their lengthy list of offerings beckons for assembly into a complete system. When, at this year's West Coast

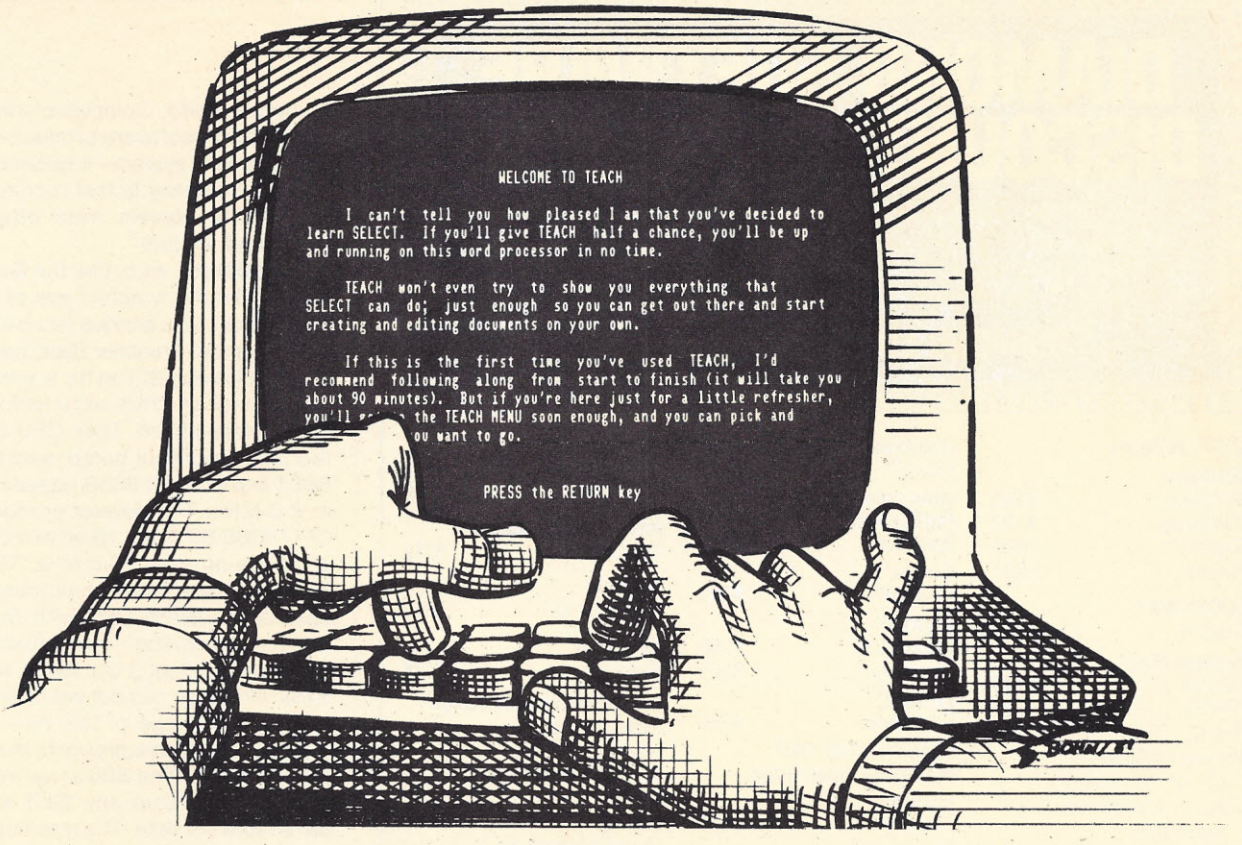


Compupro's 8085/88 board

Compupro CPU Boards vs. the Prime Number Cruncher

PROCESSOR			SOFTWARE			BENCHMARK RUN TIME
TYPE	BITS	SPEED	OPER. SYSTEM	LANGUAGE	TYPE	
8085	8	8 MHz	CP/M 2.2	Microsoft BASCOM 5.3	C	113 sec
8086	16	10 MHz	MS-DOS	Microsoft Basic-86 5.21	I	250 sec
8086	16	10 MHz	CP/M-86 1.0	Microsoft Basic-86 5.21	I	289 sec
8085	8	8 MHz	CP/M 2.2	Microsoft Basic-80 5.03	I	389 sec
8088	8/16	8 MHz	MS-DOS	Microsoft Basic-86 5.21	I	439 sec

TYPE "T" FOR TEACH.™



THAT'S ALL YOU DO TO LEARN SELECT.™

SELECT is the only word processor with this unique teaching program. TEACH takes you through each of SELECT's commands. Step by step you interact with the computer and see your progress on the screen. You can learn the basics of this fully featured word processor before you take it home. And at the end of your TEACH program (90 minutes or less) you'll be ready to use SELECT to compose, reorganize, file and manipulate just about any document you want.

When you want to Create or Erase, Move or Zap, key only the first letter of the command. After committing your document to SELECT, polish it with the help of SUPERSPELL™. SELECT's multi-thousand word spelling dictionary scouts out your spelling and typing errors and helps you correct them. SELECT's merge feature integrates your mailing lists with SELECT documents to simplify billing, forms and advertising.

SELECT runs on any CP/M based hardware and you'll see it displayed on more new hardware this year. Ask your dealer to sit you down in front of SELECT. Wave him away. Type "T" — you've just enrolled in the common sense school of word processing.

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SELECT...The Word Processing People™

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**CP/M is a trademark of Digital Research

SELECT INFORMATION SYSTEMS, INC.
919 Sir Francis Drake Boulevard, Kentfield, California, 94904 • (415) 459-4003

Computer Faire, Compupro announced its first major software product—a multi-user operating system—it became evident that the company is fast running out of excuses to abstain from offering an integrated system.

Mark Garetz, who runs the Compupro shop under the watchful eye of founder Bill Godbout, was anxious for us to run our Prime Number Cruncher Basic benchmark program (*IA* Aug 82) on his wares. Armed with a clutch of CPUs and a fistful of software, we complied. Their CPU 8085/88 is a dual processor board, with the 8-bit 8085 and 8/16-bit 8088 jazzed up to run at 8.0 MHz. The newest product is the CPU 8086/87, a full 16-bit micro running at an eye-opening 10.0 MHz. The 8087 is a hardware math co-processor that assists the 8086 CPU with the heavy number crunching. This auxiliary chip was inactive during our tests, since the Basic language has not yet been trained to take advantage of this new device.

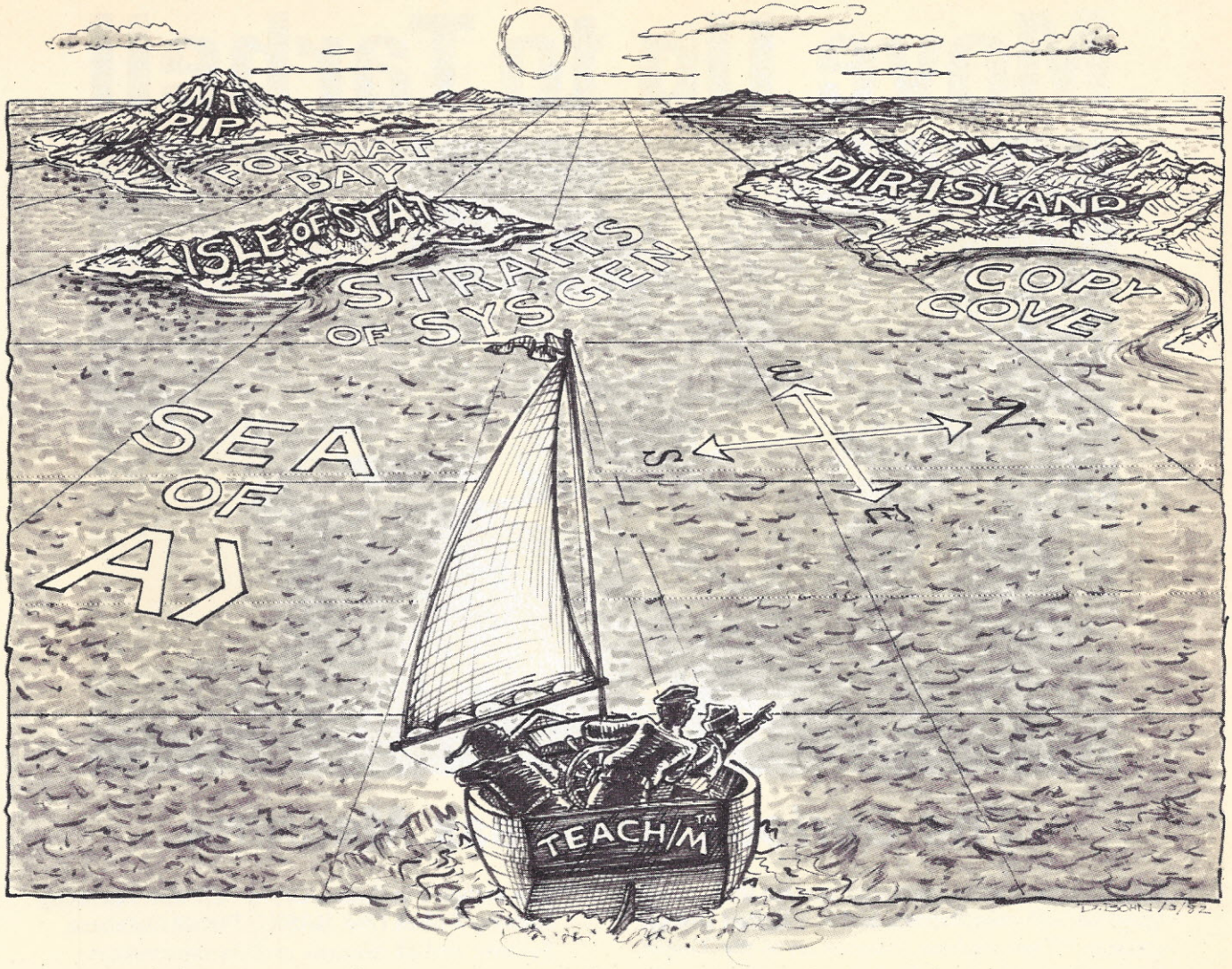
Test findings are shown in the accompanying table. The 8085 was more than a third faster than any 8-bit micro we have tested to date. The most interesting result was the slowest run of th day: the 8088 turned in a time almost twice as quick as the identically-engined IBM Personal Computer utilizing a similar software package.

Actually, there *are* such things as complete Compupro computer systems, but they are the results of the clever efforts of regional computer stores. These retail establishments have taken the trouble to build their own computer systems, feeling that a carefully matched set of Compupro pieces can run the socks off the competition. Our test results suggest that they might be right.

Shared storage

It is largely through the efforts of Corvus Systems (San Jose, CA) that Winchester-technology hard disk drives became known to the microcomputer industry. With add-on megabyte disk drives for Apples and other micros, Corvus found a need for a local area network to tie a grouping of cheap micros to a single expensive disk drive. The result was Omninet, an attractively priced method for inter-CPU communication that has been described as a workable subset of Xerox's Ethernet.

Corvus' newest product is the Concept, billed as a personal workstation node for Omninet. The Concept looks like a video display terminal with detachable keyboard. The screen can be positioned two ways: horizontally or vertically. In one configuration, it holds 56 lines of 120 characters



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If you're using today's new software, you already know about CP/M. You know it's the industry standard operating system for hundreds of computers. But if you don't really know how to use CP/M, you're facing strange, uncharted seas. That's why SELECT™ developed TEACH/M for CP/M.

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Move Up to Tarbell

The Serious Business Machine

Do you have a small computer system that operates with mini-floppies and has limited storage capacity? Then it's time to move up to the Tarbell Empire Series System. Tarbell starts where small systems leave off, providing storage from 1 to 20 megabytes. This means Tarbell is capable of growing right along with your business. (It also makes sense to start with Tarbell if you're a first-time computer buyer.)

Tarbell is the serious general purpose business machine, backed by years of experience with disk systems. It gives you word processing, inventory control with bill of materials, mailing lists — all in addition to accounting applications: general ledger, payables, receivables, payroll with cost accounting and order entry. Whatever your need may be, Tarbell can provide the working software that gets the job done.

With the Tarbell System you get a Z80 4 Mhz CPU with memory management, timer and full interrupt capability, 2 RS-232 serial ports with handshaking, 64 K bytes of random-access memory, double density floppy disk interface, 2 double density floppy disk drives, cabinet, power supply, and cables.

The software includes: CP/M™ 2.2 disk operating system, Tarbell Disk BASIC, Tarbell Database System, and all manuals and documentation.

Tarbell also offers the MP/M™ Multi-User Operating System and 4 additional RS-232 serial ports.

The Tarbell Empire Series is delivered assembled, tested, and with a FULL six-month warranty on parts and labor.

And when you need even more mass storage, Tarbell also has a hard disk that's system-compatible and provides easy back-up.

If your business is growing or you need more than a few hundred K bytes — it's time to move up to Tarbell. Call your local Tarbell dealer for competitive prices.

Tarbell Electronics

The One-Stop Shopping Service

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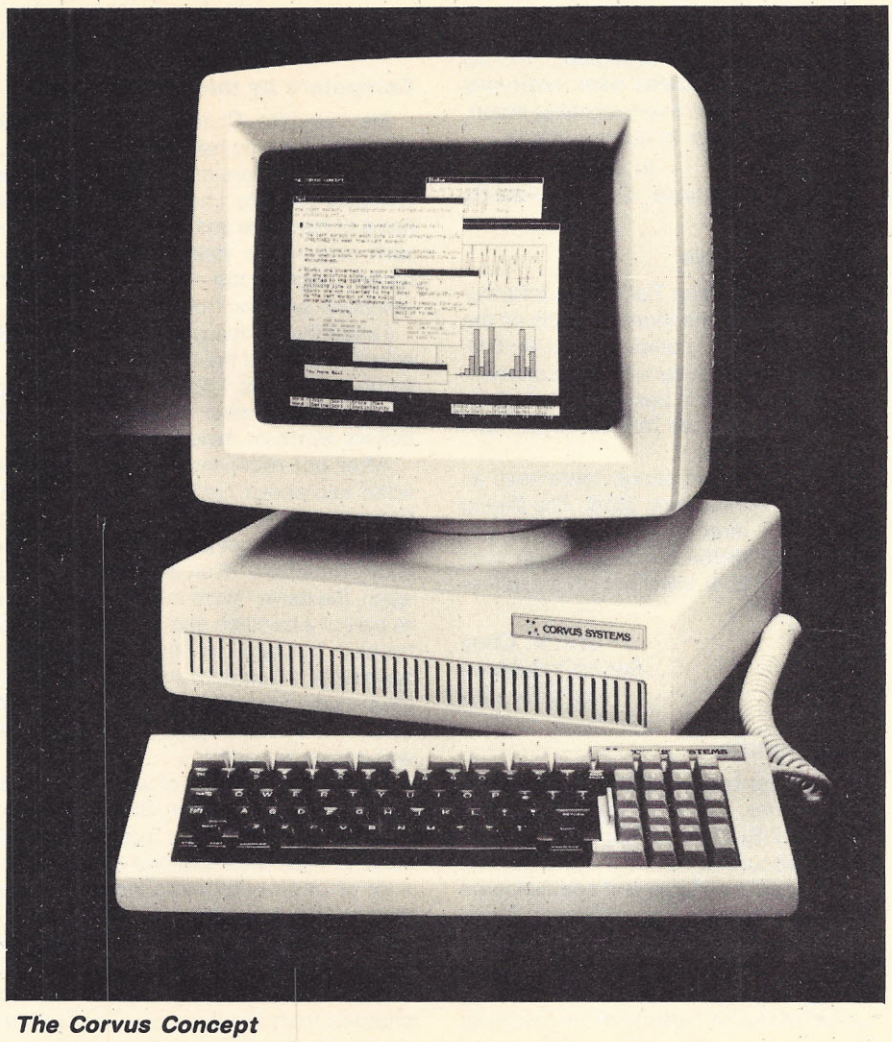
CIRCLE INQUIRY NO. 94

EDITOR'S NOTEBOOK



The Corvus Concept

each, in the other 72 lines of 80 characters. The latter corresponds to an 8½-in. by 11-in. sheet of paper and should give an idea of the intended use of the Concept—shared-storage word processing in an office environment. To that end, the Concept comes with its own built-in word processing software.

The high-resolution bitmapped graphic display and the ability to define separate windows on the screen and allocate them to various independent tasks are prominent attributes. We've spotted these capabilities in Convergent Technologies (*IA* Jun 81) and Xerox Star products, and look forward to seeing others move in this direction.

Concept's microprocessor is the 16/32-bit 68000, a design flourishing among the newest computers. Running at 8.0 MHz, the CPU is equipped with 256K bytes of RAM, its own proprietary operating system software and all necessary Omninet hardware. A clever feature of this $5,000 micro is a space inside for a group of plug-in cards of the Apple II style. Many of the Apple-compatible add-ons will work here, allowing you to instantly add local floppy or hard disk drives, printers—or even such exotica as bit pads and color graphics plotters.

Compupro and Corvus: watch them in the future. Each has something new to offer the buyer; ideas previously unavailable from old line micro makers. And that's the strength of our industry—nobody can agree on what comprises the "perfect" computer. ***—TF***

LETTERS

Plea for software

Our IBM Personal Computer is, I think, good equipment, but the word processing program furnished with it is nearly useless. When we bought the system, we did not expect the software to be sophisticated, but we did expect it to be adequate to tide us over until a better word processing program became available. We have now reached the point where we must dispose of the IBM and get a system for which good software can be obtained, unless you can direct us to usable word processing software.

Delores F. Noegel
Hollywood, FL

Micropro Int'l. (San Rafael, CA) offers an IBM version of its Wordstar, marketed by Professional Micro Systems (Newport Beach, CA). You might also investigate the IBM word processor from Texasoft (Dallas, TX). ***—TF***

Out of sight

We could really get wrapped up in your moon-mining threaded transportation proposal ("Inventor's Sketchpad," *IA* Feb 82). Given an endless wire, everyday earth spin, and an every-chasing moon, we could wind up in quite a tangle.

A. Diane McIntyre
Ottowa, Ontario, Canada

Drive alternative

I enjoyed reading Tom Fox's informative "System of the Month" article on the HP-125 personal computer (*IA* Dec 81).

I agree completely with his statement ". . . drives come in boxy, metal-wrapped desktop enclosures that somehow lack the visual pizazz . . .".

But HP-125 and series users have an alternative—the Bering 2895. The Bering 2895 is a direct replacement of the "boxy" HP 9895A 8-in. floppy-disk subsystem. It is 20% lower in cost and offers extra features.

Chin K. Choy
Bering Industries
San Jose, CA

Joint venture

The letter by Beth Slovick, sister of a programmer who worked on Blocks Authoring System (*IA* Apr 82) is somewhat inaccurate.

Any project as large and sophisticated as Blocks is the result of a large group of dedicated people. The funding, design, programming, coding, debugging, field testing, revising and disseminating are the results of the joint efforts of the following: Tim Aaronson, Ted Cohn, Computer-Advanced Ideas, Cue, Steve Dompier, E.S.E.A. Title IV-C, Andy Hertzfeld, Margart Irwin, Lawrence Hall of Science, Art Luehrmann, Ted Perry, Pete Rowe, Linda Slovick, Geoff Zawalkow and the hundreds of teachers and students in the project institutions.

Blocks 3.3, the latest version, allows students to run lessons on either an Applesoft or Integer computer with one or more disk drives. Blocks 3.3 is available only from San Juan School District. Prior versions are available from California School for the Deaf and Computer Using Educators (San Mateo, CA).

If anyone was slighted in this listing, I apologize; it was purely unintentional. Our goal is to deliver the capability of developing computer-assisted instruction lessons into the able hands of the classroom teacher. To date, the authoring system has been sent to over 1,100 school systems in the U.S. and Canada.

Ted Perry
Coordinator
Computer Assisted Instruction
San Juan School District
Carmichael, CA

Computers by mail

Re: "Update: Computers by Mail" (*IA* Mar 82), on buying hardware and software, I would like to share my recent experience with your readers. I have ordered several items of hardware and software previously with only minor delays. However, my recent experience with a mail order company was far from satisfactory.

I used the company's 800 number and asked the clerk if the items were in stock. As he replied yes, I placed an order using my Visa card number for several hundred dollars worth of merchandise.

After not receiving the merchandise within two weeks, I called again, asking for the same clerk who took my order. The items "had sold out and were expected in within the week." Ten days later, I called again, the items "were in—although some as part of a package deal," but they would break a package to fill my order. Five days later, I called for the third time. My order had gone to shipping and was sent back—out of stock again! A new shipment was expected soon.

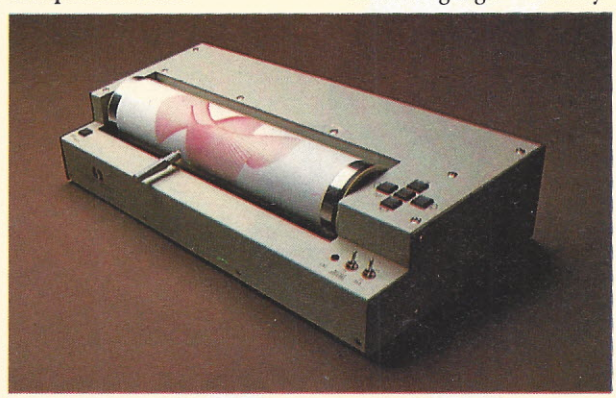
Finally after 33 days of waiting, I called and cancelled the order. Since my order was not even filled after a new shipment came in, I can draw only one conclusion—a lot of other customers were awaiting their orders ahead of me so the merchandise could *not* have been in stock when I ordered. But the real shock came when I received my Visa bill—there were the charges from the company, posted the day I ordered. For those of us who pay charges from the day of purchase, this is

How to chart your company's fortune without spending one

It's a fact. A single chart or graph can tell you instantly what it takes hours to interpret from printouts or other raw data.

Now, with the Strobe 100 Graphics Plotter and Software package, you can create superb hardcopy graphics directly from your computer. And you can do it for a fraction of the cost of most other systems.

The Strobe System transforms complex data into dynamic, colorful visuals with a few simple commands from your computer. Charts and transparencies that once took hours to produce are plotted within minutes. Information can be presented as bar charts, pie charts, curves or isometrics in a variety of colors. And with a resolution of 500 points per inch, the Strobe 100 matches or surpasses the quality of plotters costing thousands of dollars more.



You can also save and modify your graphics through Strobe's menu-driven programs. A broad selection of software—including data base management-compatible programs—is now available.

When the Strobe Graphics System is interfaced to your computer, an 8-1/2 x 11 inch sheet of paper can speak anyone's language—visually. Visit your local dealer and learn how to start charting your fortunes today. Because a perspective on the present can also be your window on the future.

STROBE INCORPORATED

Strobe Inc.
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Telephone 415/969-5130

The Strobe Graphics System

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CIRCLE INQUIRY NO. 91


Keeping up
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10 function keys*
10-key numeric pad
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Power-on self testing*
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High-resolution*
80 characters x 25 lines
Upper and lower case
Green phosphor screen*
Operating Systems
DOS, UCSD p-System, CP/M-86†
Languages
BASIC, Pascal, FORTRAN, MACRO Assembler, COBOL
Printer
Bidirectional*
80 characters/second
12 character styles, up to 132 characters/line*
9 x 9 character matrix*

Permanent Memory
(ROM) 40K bytes*
Color/Graphics
Text mode:
16 colors*
256 characters and symbols in ROM*
Graphics mode:
4-color resolution: 320h x 200v*
Black & white resolution: 640h x 200v*
Simultaneous graphics & text capability*
Communications
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Up to 9600 bits per second

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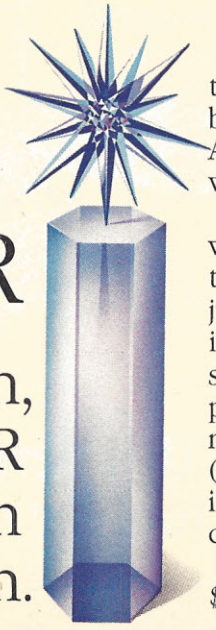
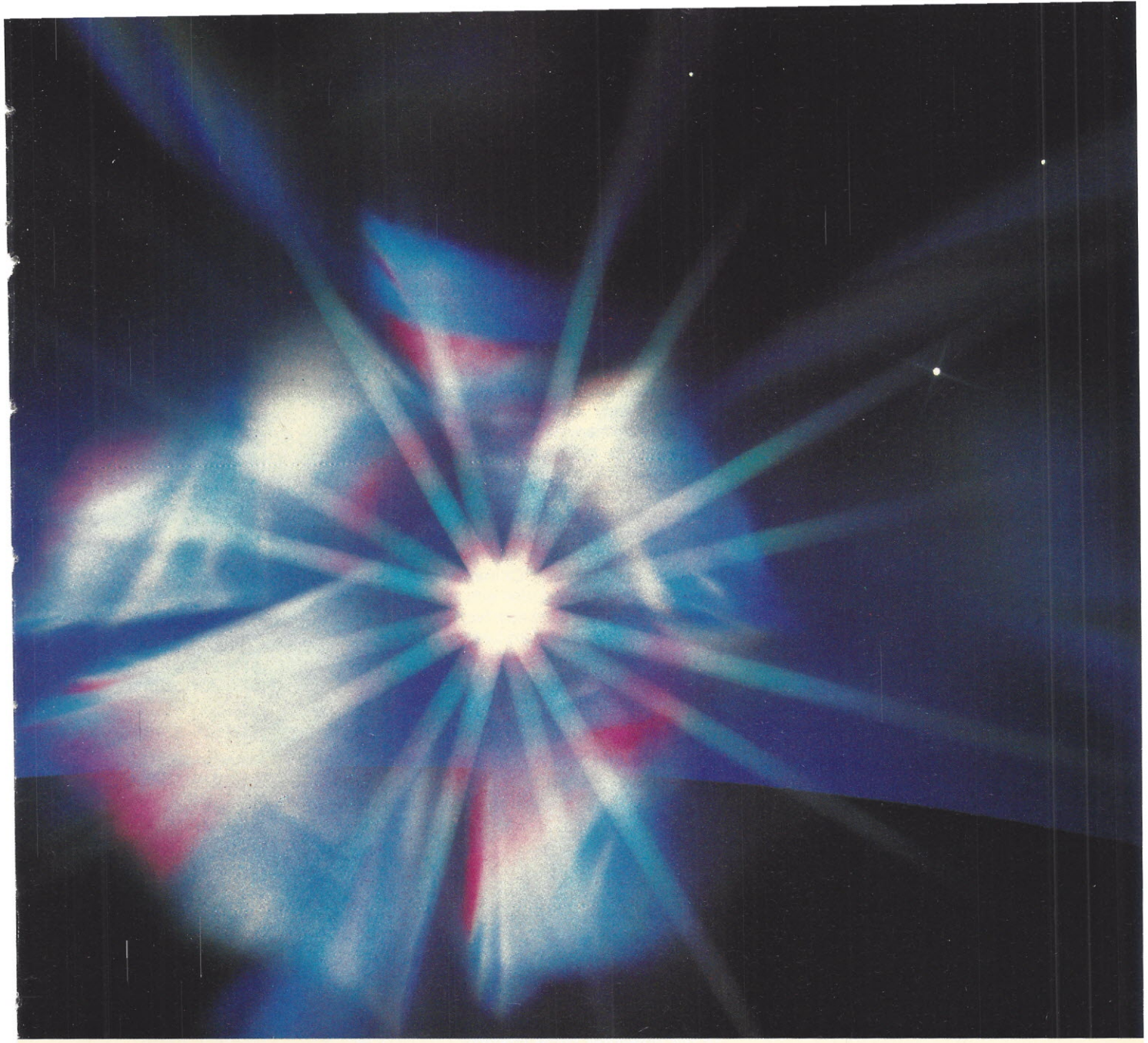


ATARI is looking for some of the greatest software from the brightest stars in the software field. And naturally, we're willing to reward you for it.

Every three months, ATARI will be presenting ATARI STARS to the writers of software programs judged first, second and third place in the following categories: consumer (including entertainment, personal interest and development); education; home business (personal finance and record keeping); and system software. The decision of the ATARI judges is final.

Quarterly prizes will be from $750 to $3,000 worth* of selected



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To be eligible, your software idea must be submitted to and published in the ATARI Program Exchange catalog. Submit your program on the official entry form which we'll rush to you if you send in the attached coupon.

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Yes, I want to enter the ATARI ASAP competition. Please rush me my entry form.

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CIRCLE INQUIRY NO. 8

a rip-off. I called the company and was told it was company policy to charge it when ordered. Not only was I lied to about it being in stock, I was charged for something that was never shipped—33 days worth of charges. One week after I cancelled the order, I had not received a copy of the cancelled Visa charge.

I have learned my lesson—I will not deal with this company again and will be extremely cautious before I use my Visa by phone again.

Carl H. Garrison
Richardson, TX

Word processor additions

David D. Busch's "Word Processing Software: Comparison of Programs for the TRS-80" (*IA* May 82), while very helpful, should have included Newscript (by Prosoft, North Hollywood, CA). Its price is in the range of the lower-cost word processors reviewed, but it does just about everything attributed to the more expensive programs. Also Scripsit (Radio Shack), which actually exists in the marketplace, should have been included. (Super Scripsit as of this writing has not appeared.)

One advantage of Scripsit is that you can print without saving on disk first; Newscript text gets saved, thus slowing down the process if you do not wish to save the text. But the latter program has many advantages including real proportional printing (subject, of course, to printer limitations), access to non-keyboard characters, form letter capacity, direct keyboard entry, automatic save and lots of other features. New versions come out regularly and are inexpensive to purchasers.

This fine program is a viable candidate for "favorite TRS-80 word processor." I find that Newscript does all it is supposed to on the model III. (At first it takes considerable leafing through the hefty and thorough manual, but the results are worth it.)

Karl J. Reinhardt
Houston, TX

Women use computers too

Re: "General Ledger Software in the Balance" (*IA* Apr 82), I greatly benefited from Carl Heintz's general ledger feature comparison chart, as I will be purchasing a computer system and software to accommodate my accounting practice in the near future. Although this article is presented as an objective presentation of facts, I would like to relate a subjective experience I had as a result of reading your article.

I took note from the information on this chart that the Radio Shack software for the TRS-80 model II has an outstanding amount of the features I require. It seems that they have thought of everything—except a large portion of their potential market. The video tape that I subsequently viewed that was prepared by Tandy to promote the above mentioned package was a surprisingly unprofessional attempt to entertain (?) with sexual innuendos. The attempts at "humor" were entirely directed to the male audience.

One would expect that a large corporation like Tandy would have the most sophisticated marketing wizards at their disposal. It is not expected that they would overlook and disregard a very large and growing market of women in business. In this presentation, they really miss their mark because I believe that it is in such poor taste that even the males that view it feel insulted. Of the persons who viewed the presentation with me, the women outnumbered the men two to one.

I will look long and hard before I will invest thousands of dollars with a company that ignores me, the businesswoman, as a potential customer and insults my male counterpart with a sexist attempt at humor. Please inform your readers and advertisers that women buy computer hardware and software.

Vanessa Bondon
Los Gatos, CA

Pirate invasion

Re: "Game Corner" (*IA* Jan 82), the column contains some inaccuracies that seem prevalent in the software field. The first is the belief that neither patent nor copyright law offer "any kind of protection to the computer game industry."

I agree that patent law is useless, but the main reason is not that games are not patentable per se, but that the patent process takes so long that by the time the programmer got the patent, the game would have played itself out in the marketplace. Patent law as applied to software is too new to be able to accurately predict how it will go. The current cases do not necessarily limit patent protection to industrial processes, however.

The second inaccuracy states that copyright law only protects "programs from copies that are bit-by-bit identical." This is a widespread misconception that stems from the practical problem of how to prove your case. The copyright law in fact protects programs from illegal copying. The question then becomes how to prove the program was actually copied. Obviously, bit-by-bit copies are easier to prove than copies that have been made and altered before the object

WHAT IS THE TRUE COST OF A DISKETTE?

If you said at least $186.50*, you're probably close.

Confused? It's simple. The minimum cost of a one-sided, single density 8" diskette equals the purchase price plus the cost of the time to fully load the data onto the disc*. The adjacent diagram tells the story. As you can see, the purchase price of a diskette is a small fraction of the total cost of ownership. So why not pay a few cents more for the best diskette available?

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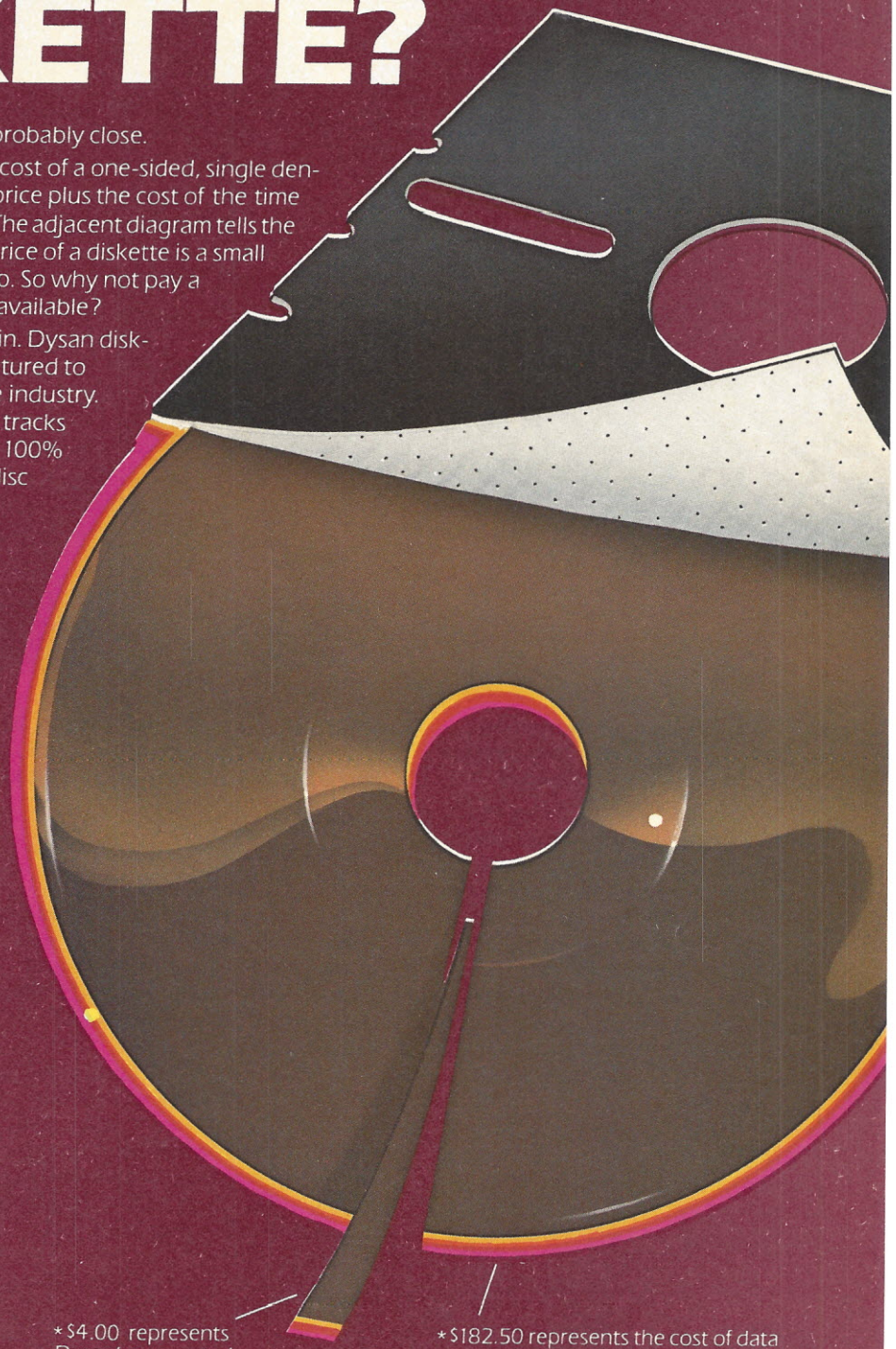

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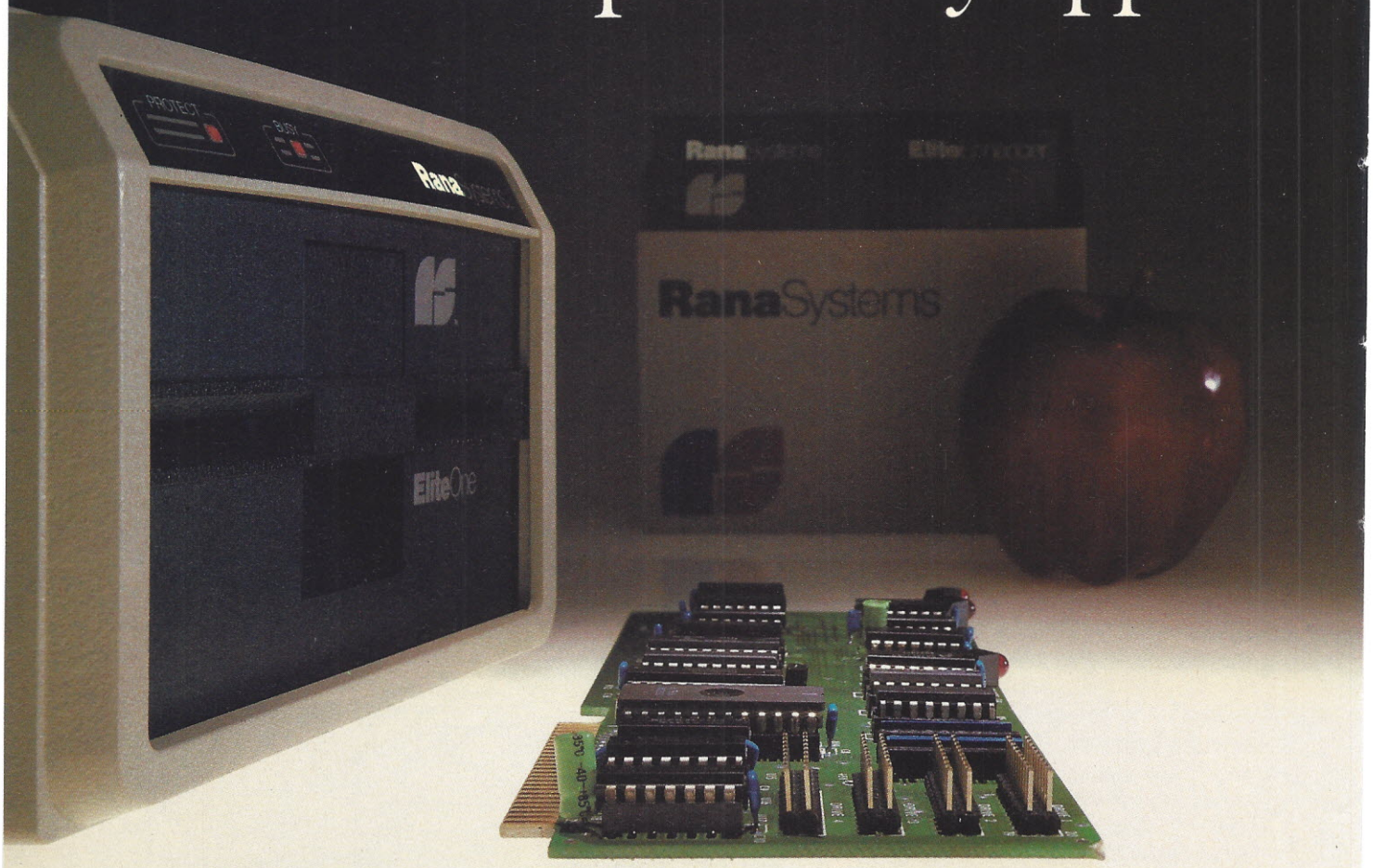
*$4.00 represents Dysan's suggested retail price for a one-sided, single density 8" diskette, packaged ten to a box. Minimum total cost of ownership = $186.50

*$182.50 represents the cost of data loading (approximately 22 hours at 11,106 keystrokes/hour at a labor cost of $8.23/hour), based on 1981 Data Entry Management Association (DEMA) National Averages.

It's the best part of any Apple.



Your Apple computer can grow from ordinary to awesome in a matter of minutes.

The Elite disk drive Series by Rana Systems *gives* you that kind of magic. Quickly, easily and cost-effectively.

This superb family of sophisticated floppy drives was designed and perfected by a team of industry-respected engineers expressly for Apple® computer owners who have long been demanding more disk drive for their money.

Now they *have* a drive that makes an Apple perform the way it should. For example;

Elite One, the most economical Rana drive, delivers 15% more storage capacity than Apple's drive. The top-of-the-line Elite Three will provide an astonishing *four-times* more storage, approaching hard disk performance. It's done through exclusive high-density single and double-sided disks and heads.

Here's a tantalizing taste of just how formidable your Apple can become.

Next to enormously increased disk space, Apple buyers are most excited about Rana's fingertip Write/Protect feature. A pushbutton on the LED-lit panel gives you a new measure of failsafe control.

While Elite drives are all plug-compatible with Apple's controller, Rana's vastly superior controller card is a *must* for those with growing data processing demands. With it, you control up to *four* floppy drives using only one slot...while still utilizing your Apple computer to achieve dramatic new heights of system flexibility and processing power.

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CIRCLE INQUIRY NO. 82

LETTERS

code stage. But if you can prove that the infringing copy was in fact a copy, you will prove your case. How is this done? There are several ways. Circumstantial evidence can be used. An example of this is when a trusted employee quits and sets up a competing business with a similar program. Sometimes a bug in the original appears in the copy, even though the programs look different. Sometimes, an employee of the infringer will testify. Clearly, you will not be able to prove every case of copying, but it is not impossible, and if the programmer filed his copyright forms properly, he may be able to get attorney fees from the copier in addition to money damages and an injunction.

The authors neglect to mention trade secret law. I generally recommend to my clients that they maintain their flowcharts and source codes as trade secrets, releasing only their object codes. This has the obvious advantage that it is difficult to alter object code programs without the source code. Suppose, however, someone steals your flowchart. Trade secret law can come to your protection with injunctions, damages and—in some cases—criminal penalties. Again, you have to prove your case, but you have to prove your case in all areas of the law from software piracy to arson.

The writers of "Game Corner" are correct in wondering if the industry deserves its own set of laws. The issues are complex and in many ways do not lend themselves to analogy from the world of literature or inventions.

Daniel Remer
Attorney-at-Law
El Cerrito, CA

Many companies are spending too much time and money worrying about pirates. They reduce (if not ruin) the usability of their programs with locked disks, unlistable programs, secret source code, hidden locks, codes in ROM chips, full page ads devoted to pirates (e.g. Atari), etc. These devices have made many programs inefficient, costly to produce and support. The buyer cannot make modifications or back-up copies. Often he is inconvenienced by added expenses for back-ups or future modifications. This hurts sales and angers good customers.

There is a better way. Our company produces Apple II software for health professionals (medical/dental systems, appointments, hypnosis, etc.) All our software is unlocked and can be copied for back-up purposes. We support all sales offering free replacement of damaged disks. All our software is listable and can be modified by the user. There is internal as well as written documentation.

Our customers like this. They are buying a program . . . not a software lease. They have immediate support since changes and problems can be made over the phone or by letter. They can back up immediately and for as many times as needed.

But what about pirates? Large scale pirates—those enterprising souls who copy our programs and sell them worldwide—are discovered and given an option to become our dealers and pay us a royalty on distributed sortware (or meet us in court). As in the old sailing days, reformed pirates (privateers) make the *best* dealers and we don't mind sharing the wealth. For those who don't want to cooperate, we go back in history for the remedy. The English and Spanish both learned that a few executions were good for morale of the troops. Small time pirates can be controlled by low program cost, registration, continuing updates and documentation. It just doesn't pay to get our programs second-hand.

It is time the industry realizes that our prime business is producing and distributing a product—not fighting pirates.

E.J. Neiburger
Andent, Inc.
Waukegan, IL

Reader interface

I am attempting to interface an IBM 1230 optical reader to a TRS-80 model II. I would appreciate hearing from anyone who has or intends to do the same.

Louis M. Ferrari
3919 Octave Dr.
Jacksonville, FL

We want to use our TRS-80 model II for typesetting. Can any of your readers provide help? We use the Scripsit word processing program and can express mail floppy disks or transmit electronically with a modem. We would like to locate either a typesetting service that can handle our output or information on hardware that we can buy to do the job. We're not interested in optical scanning.

Robert A. Palmer
Professional Publications
Box 80280
Atlanta, GA 30366

I would like to correspond with an Apple II Plus owner in the states.

Phil Jackson
Box 184
Dunedin, New Zealand

Business software products announced for IBM PC

Manufacturers are keeping pace with the fast-growing interest in the IBM Personal Computer. A number of business software packages have been introduced to complement the IBM system.

Professional Micro Systems (Newport Beach, CA) has released a comprehensive line of IBM products, highlighted by a fully-integrated Accounting Plus package that runs under CP/M 86 (Digital Research, Pacific Grove, CA).

Included are order entry, inventory control, sales analysis, purchase order, accounts payable and receivable, payroll and general ledger. Required with the package is Professional Micro Systems' 20M-byte hard disk add-on for the IBM unit.

Among other IBM software announced by Professional Micro Systems are a client write-up program, a "Super" version of Supercalc (Sorcim, Santa Clara, CA) that increases memory capacity from 64K to 512K bytes, and an IBM version of Wordstar (Micropro, San Rafael, CA).

Several other packages (all available through IBM product centers) include: Inventory Control (Peachtree Software, Atlanta, GA), Dow Jones Reporter, Time Manager and Cobol compiler (Microsoft, Bellevue, WA). An updated 1.1 version of Visicalc (Visicorp, San Jose, CA) will accommodate up to 256K bytes of user memory, and will support additional parallel and serial printers. Visicorp will automatically issue the upgraded version free of charge to all of its warranty registrants.

No single standard seen for local area networks

The business of local area networking is not likely to adopt a widely-accepted system, according to a recent study by Venture Development Corporation (Wellesley, MA).

The requirements are too diverse to allow one system to satisfy all of the different user groups, whose needs are determined by application (data processing, office equipment, and factory automation) and by the size of the company, according to the report. Several de facto standards are expected to be adopted by 1985.

Different user segments will require different access methods. For large data processing systems, for real time process control and for larger local area networks that interconnect smaller ones, TDMA (Time Division Multiple Access) will be used. For factory automation and laboratory systems, token passing will be preferred. CSMA/CD (Carrier Sense Multiple Access with Collision Detection) is suited to office automation where traffic is "bursty" and not extremely heavy.

The CSMA/CD access method, used by Xerox' Ethernet, has advantages and disadvantages. The disadvantages are unbounded transmission delay time (due to collision), equal access to all devices (independent of importance), increased collisions as data traffic increases, and reduced throughput as maximum node-to-node distance increases at a given data rate.

The VDC report reveals a dichotomy between attitudes and beliefs of manufacturers of local area networks and the users. For example, 70% of potential users surveyed believe that it will be necessary that their local area networks carry voice and video as well as data within the next five years; only 10% of the manufacturers voiced their belief that users have this need. Users are more optimistic than vendors regarding the overall growth of the market.

Index and directory to list micro articles, programs

A subject and abstract guide to 20 microcomputer magazines and descriptions of more than 5,000 microcomputer programs will be available via the Dialog Information Retrieval Service (Palo Alto, CA).

Microcomputer Index, File 233, will begin with approximately 6,000 records from 1980 to the present and will be updated quarterly with approximately 1,200 items. The International Software Directory, an index of micro programs for the expert, novice or games player, is File 232.

The index will contain a short summary or abstract and complete source information—author, title, journal, date—plus indexing terms. General articles, book and software reviews, discussions of applications and descriptions of new products are included.

Directory editors will attempt to list all commercially-available software for any

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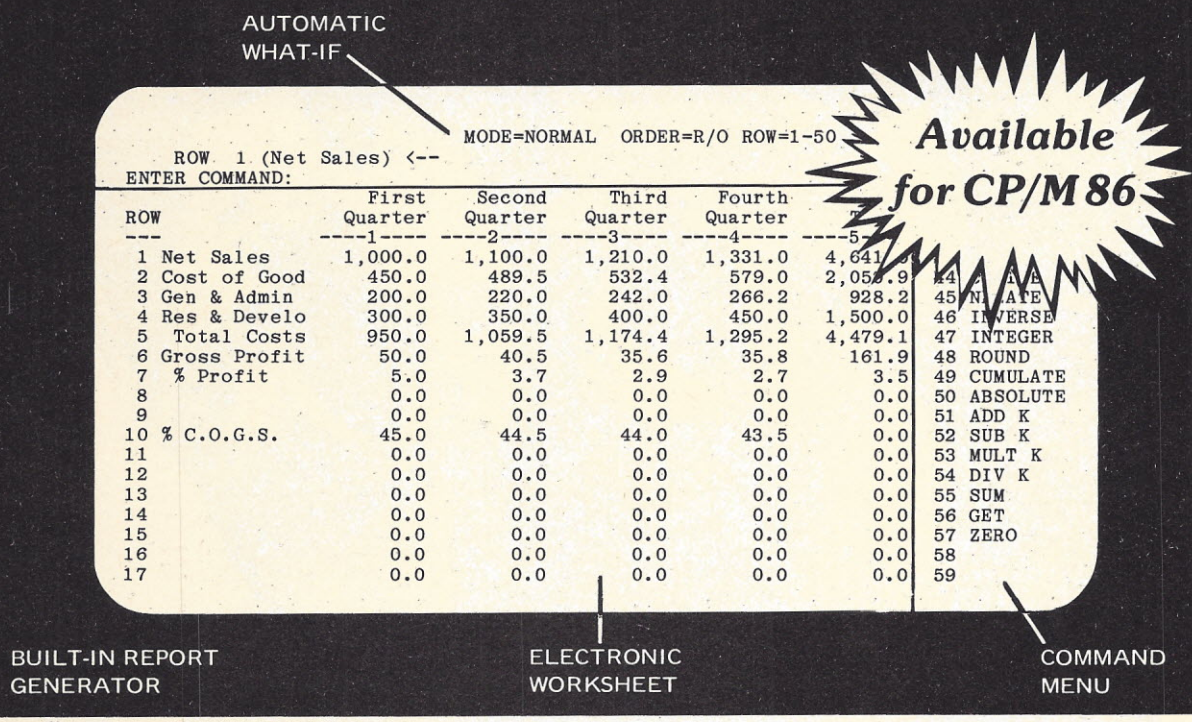

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The industry is buzzing with comments on MicroPlan. Users have supplied unqualified quotes "the best . . . ever."

ALTOS COMPUTERS agrees. The ALTOS budgeting manager uses MicroPlan for revenue forecasts, consolidations, and everyday analysis. DURANGO's Product Manager uses MicroPlan for product pricing and for developing marketing strategies. TOSHIBA's General Manager uses MicroPlan for developing marketing strategies. The DNYABYTE VP of Finance simply says, "it's dynamite!"

And, ADDS' system staff maintains budgets; TELEVIDEO's Controller reports financial performance; and NORTH STAR's Marketing Manager analyzes sales—*all in MicroPlan.*

MICROPLAN IS EASY TO USE. You don't type; so MicroPlan is designed for no typing ease. You don't think in formulas; so MicroPlan is designed for pushbutton ease. You are not a programmer; so MicroPlan eliminates all the computerese that makes life difficult.

MICROPLAN SOLVES PROBLEMS. MicroPlan lets you solve your problems electronically. You enter values into the electronic worksheet. MicroPlan handles all the sums, percentages and ratios. Even complex depreciation, loan analysis and present value computations are supplied—all with pushbutton ease. And when you change one number, MicroPlan automatically analyzes the impact of "what-if" questions.

MICROPLAN HAS POWER. MicroPlan has more features and solves more problems. Add-on modules allow you to do consolidations, automated variance analysis, statistical calculations—it even lets you build complex models. And, with MicroPlan solution books you can apply MicroPlan to *your* business, such as, real estate, tax planning, and sales forecasting.

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Birth of a legend.

Epson.

A whole new generation of Epson MX printers has just arrived. And while they share the family traits that made Epson famous — like unequalled reliability and ultra-fine printing — they've got a lot more of what it takes to be a legend.

For instance, they've got a few extra type styles. Sixty-six, to be exact, including italics, a handy subscript and superscript for scientific notation, and enough international symbols to print most Western languages.

What's more, on the new-generation MX-80, MX-80 F/T and MX-100, you get GRAFTRAX-Plus dot addressable graphics. Standard. So now you can have precision to rival plotters in a reliable Epson printer. Not to mention true backspace, software printer reset, and programmable form length, horizontal tab and right margin.

All in all, they've got the features that make them destined for stardom. But the best part is that beneath this software bonanza beats the

Uh...three legends.

heart of an Epson. So you still get a bidirectional, logical seeking, disposable print head, crisp, clean, correspondence quality printing, and the kind of reliability that has made Epson the best-selling printers in the world.

All of which should come as no surprise, especially when you look at the family tree. After all, Epson *invented* digital printers almost seventeen years ago for the 1964 Tokyo Olympics. We were the first to make printers as reliable as the family stereo. And we introduced the computer world to correspondence quality printing and disposable print heads. And now we've given birth to the finest printers for small computers on the market.

What's next? Wait and see. We're already expecting.

EPSON
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FEATURE	ORIGINAL MX-80	GRAFTRAX-80*	ORIGINAL MX-100	MX-80 with GRAFTRAX-Plus	MX-80 F/T with GRAFTRAX-Plus	MX-100 with GRAFTRAX-Plus
Bidirectional printing	X	X	X	X	X	X
Logical seeking function	X	X	X	X	X	X
Disposable print head	X	X	X	X	X	X
Speed: 80 CPS	X	X	X	X	X	X
Matrix: 9 x 9	X	X	X	X	X	X
Selectable paper feed			X		X	X
PAPER HANDLING FUNCTIONS						
Line spacing to n/216		X		X	X	X
Programmable form length	X	X	X	X	X	X
Programmable horizontal tabs	X	X	X	X	X	X
Skip over perforation			X	X	X	X
PRINT MODES AND CHARACTER FONTS						
96 ASCII characters	X	X	X	X	X	X
Italics character font		X		X	X	X
Special international symbols				X	X	X
Normal, Emphasized, Double-Strike and Double/Emphasized print modes	X	X	X	X	X	X
Subscript/Superscript print mode				X	X	X
Underline mode				X	X	X
10 CPI	X	X	X	X	X	X
5 CPI	X	X	X	X	X	X
17.16 CPI	X	X	X	X	X	X
8.58 CPI	X	X	X	X	X	X
DOT GRAPHICS MODE						
Line drawing graphics				X	X	X
Bit image 60 D.P.I.		X	X	X	X	X
Bit image 120 D.P.I.		X	X	X	X	X
CONTROL FUNCTIONS						
Software printer reset		X		X	X	X
Adjustable right margin			X	X	X	X
True back space		X		X	X	X
INTERFACES						
Standard — Centronics-style 8-bit parallel	X	X	X	X	X	X
Optional — RS-232C current loop w/2K buffer	X	X	X	X	X	X
RS-232C x-on/x-off w/2K buffer	X	X	X	X	X	X
IEEE-488	X	X	X	X	X	X

*Tandy TRS-80 block graphics only available with GRAFTRAX 80.

type of microcomputer. Listings will include short descriptions of each software item along with indexing by broad application categories such as medical, dental, educational, scientific and systems. Items are coded by names of compatible computers.

Small law firms to increase in-house computer services

In-house legal research and litigation support will automate even the smallest law firms within the next decade, according to Jeff D. Emerson, vice president and general manager of Litigation Management Support Team, Informatics, Inc. (Woodland Hills, CA).

"Law firms will find it cost-effective to automate cases involving as few as 1,000 documents on their computers, and the creation of databases will be facilitated by word processing machines that capture information at the source in machine-readable form," Emerson said.

Time-shared legal and business databases will become unrestricted and more user-friendly for the computer-assisted researcher, and those databases will be accessible through common terminals and languages, he said.

Private files are now being computerized to give law firms maximum use of previous projects and such systems will be available first through time-shared devices and later through word processing equipment connected to a computer in the law firm, Emerson added.

Computer training program simulates work environment

A Washington, D.C. consulting firm has created a program to help meet its need for a staff with computer skills, abstract reasoning ability, and experience in dealing with people. The program could provide a low-cost resource for professionals seeking a career-switch.

Prince Analysis Inc. has offered its month-long program four times; those enrolled pay $50 tuition fee, meet once a week for four weeks and are required to do six hours' homework a week.

Most of those applying for the course—about 80 in all—heard of it by word-of-mouth, although the firm has begun to advertise. A dozen applicants passed initial screening, and six have finished the course. Three of those finishing have been hired by Prince, and the other three have proceeded to more formal and structured training programs.

Prince's course is diagnostic—designed to simulate a working environment. It emphasizes independent study, fundamental learning skills and rapid integration of a large body of unfamiliar material.

Prince president Steve Mills, who hopes to expand the program, considers educators, writers, nurses and social service workers as prime candidates for the program, as jobs in those fields are tight and salaries are low.

USC spokesman speaks out for computer literacy

Look before you leap into a sea of bytes, bits, hardware and software, a University of Southern California computer expert warns.

"We're gadget freaks. All too often, we rush to embrace a new technology without considering the consequences," says Jack Nilles, director of the Information Technology Program at USC's Center for Futures Reseach.

"According to market estimates, about a million Americans will buy personal computers this year. But many of those people have very little technological savvy. They simply don't know what they're getting into."

Nilles says potential buyers should consider the pros and cons of personal computers, then decide if the pros outweigh the cons for them.

"Personal computers can help you get organized. They can help you with your income taxes. They can help you balance your checkbook. They can even help to organize and cross-reference your gourmet recipes. In short, they can take care of those niggling odds and ends that clutter up your life," Nilles asserted. He also indicated that computers offer an informal, self-paced alternative to structured learning.

Nilles also pointed out some of the disadvantages of computer ownership: "Personal computers can become addictive. They can take up far more of your time than you should allow." As personal computer owners become more proficient, Nilles explains, the temptation to experiment with new programs and to use the computer for entertainment usually increases.

"Personal computers can also take more of your money than you can realistically afford. Some are as cheap as $100, but they're nothing more than kits to be assembled and hooked up to your television set. To get a computer with substantial programming capabilities, you have to pay at least $1,000. And the average personal computer, at today's prices, will run you $4,000."

Atari wins copyright suit in Chicago Federal Appeal

A unanimous ruling in favor of Atari, Inc. (Sunnyvale, CA) has been issued by

the U.S. Court of Appeals for the Seventh Circuit in Chicago, IL, against North American Philips, manufacturer of the Odyssey home video game.

In the 29-page unanimous opinion, the U.S. Court of Appeals reversed a lower court ruling—and thus expanded the copyright protection available to video games.

The Court held that North America Philips had infringed upon the rights of Atari, the exclusive home video market licensee of the popular video game *Pac-Man*. Atari licensed the home video rights from Namco Limited, the Japanese company that created the *Pac-Man* game.

Odyssey offered a home video game, *K.C. Munchkin*, which Atari claimed was a copy of *Pac-Man*, to which it holds exclusive rights. The Court of Appeals in directing the District Court to enter a preliminary injunction against the continued infringement of the Atari copyright, stated "...a preliminary injunction is necessary to preserve the integrity of the copyright laws, which seek to encourage individual effort and creativity by granting valuable enforceable rights."

Raymond E. Kassar, Chairman of the Board of Atari, Inc. said, "This ruling has enormous implications for the video game industry and especially for Atari. The Court has clearly come down on the side of protecting creativity. Atari will continue to commit substantial human and financial resources to research and development secure in the knowledge that our efforts will be protected by the Courts."

National computer owner survey is announced

A national computer survey is underway to research the products, services and publications that computer owners need. The survey will be the subject of a future report by Irv Brechner Enterprises (Livingston, NJ).

To induce users to participate, there will be a random drawing for 51 prizes from all entries received by November 15, 1982. There will be one grand prize of $500 and 50 additional $10 prizes.

The computer survey asks for very basic information—name of computer brand, number of disk drives, publications subscribed to, programming languages used, etc.

The major portion of the survey is expected to indicate what new products, services or publications consumers would like to see.

Details are available from National Computer Survey, Box 453, Livingston, NJ 07039.

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This book applies a hands-on approach to learning WordStar, an extremely popular and yet practical word processing system. This self-teaching manual allows you to use WordStar starting with Lesson 1. Hours of frustration can be eliminated by following the 14 time-saving lessons and examples presented here. By teaching you to use this contemporary program one step at a time, this book enables you to use WordStar comfortably without the inherent burdens of teaching yourself a new system. It comes with a convenient pull-out Command Chart that can be kept nearby as a quick reference to all of WordStar's most useful commands.
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CP/M® User's Guide
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If you haven't yet purchased CP/M® for your system, this book will help make your first use of CP/M® much easier. If you already have a CP/M® -based computer, the book presents everything you'll need in order to jockey your disks like an expert. It begins by giving an overview of PC/M, then describes types of CP/M® and their compatibility. It also explains why there are different types of CP/M® . All CP/M® and their commands and utilities are explained in detail. The next section covers programs and how to run them. Both sections are meant to be used alongside your computer as helpful references. Finally, the book makes important suggestions for optimum use of your computer system.
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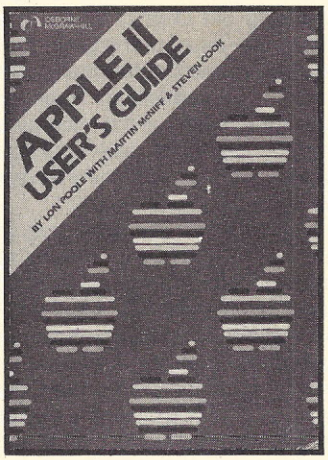

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Lon Poole, Martin McNiff and Steven Cook

It's all here in the new Apple II User's Guide. This guide will compliment your owner's manual and give your a heightened understanding of your Apple II. With this book you'll be able to program in BASIC. You'll be able to use the sound and graphics features of the Apple II to create your own colorful video games. There's also a review of the Apple II printer as well as a chapter on controlling "Real" processes, like burglar alarms and appliances.
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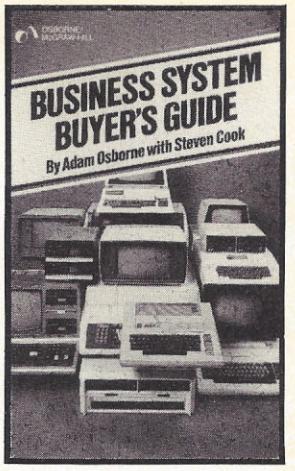

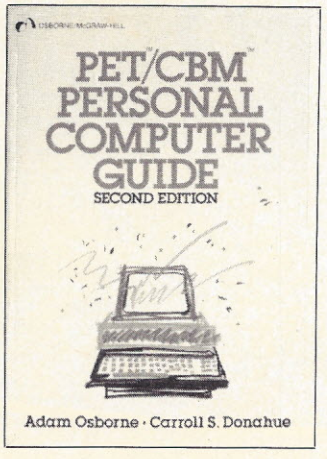

PET/CBM Personal Computer Guide, 2nd Edition
Adam Osborne and Carroll Donahue

If you are thinking about buying any personal computer, this book will show you what the PET can do for you. If you've just bought a PET of CBM, this is the book you must have to really understand your computer. By using the examples found in this book, you'll quickly get your PET/CBM up and running. These examples are thoroughly documented so you can learn how and why the programs work. It's the how and why that are important in learning to make the PET work efficiently for you. This book covers everything you'll need to be a master of your PET.

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Adam Osborne, Gordon Eubanks and Martin McNiff

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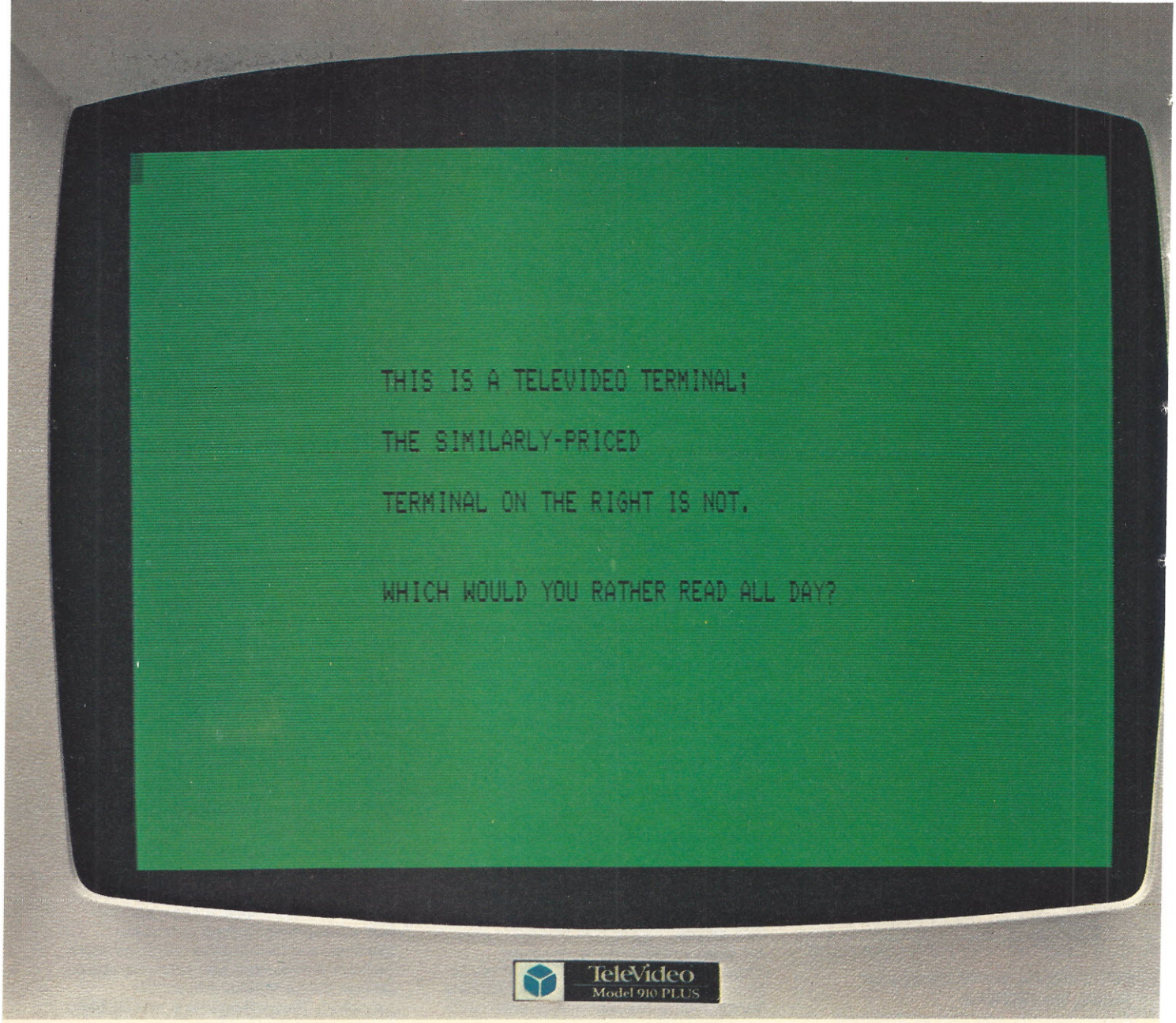

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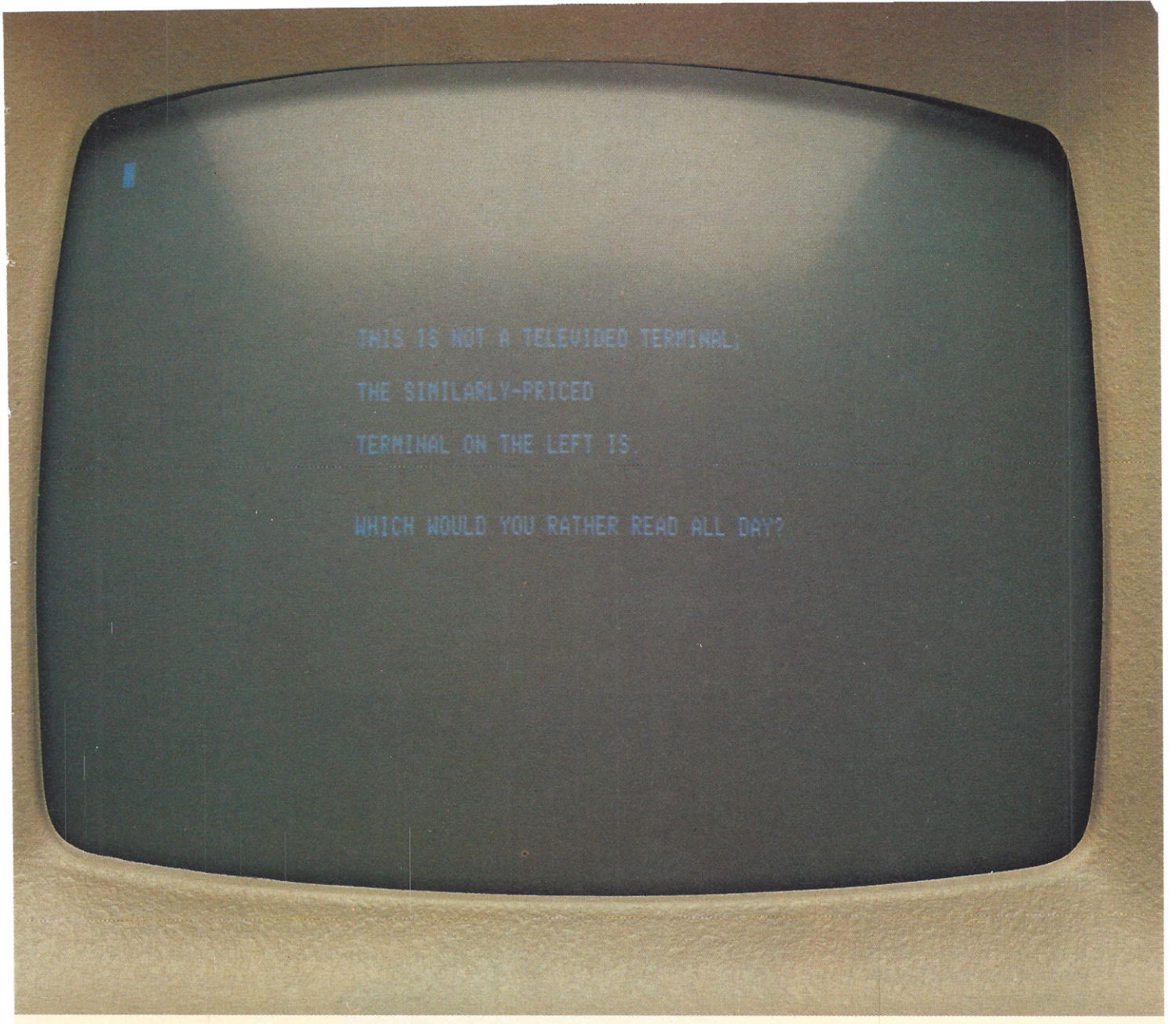

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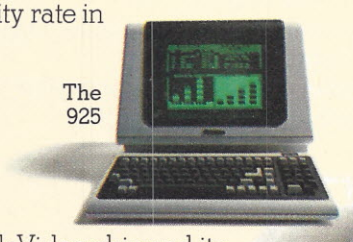

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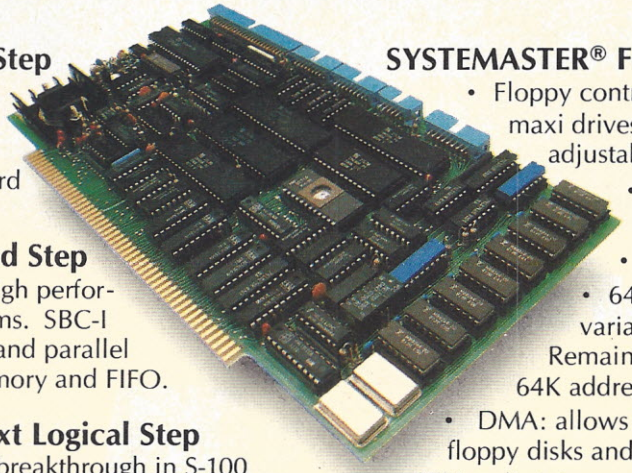

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GAME CORNER

by Patrick and Leah O'Connor

Dot Game

Computers are particularly adept at scientific calculations, business applications and many other time-consuming tasks, but they are not as competent in pattern recognition.

Consider a simple pen-and-paper game called connect the dots. Imagine a grid of dots at least four dots wide by four dots deep. The two players each use a different colored pencil to connect adjacent dots. The object of the game is for one player to connect a continuous trail of dots from the upper left corner of the board to the lower right corner of the board. At the same time, the second player is trying to draw another trail from the upper right hand corner to the lower left hand corner. Players alternate drawing lines and neither player can draw a line across his opponent's trail.

For human participants, this is a very simple undertaking. We can look at the board and see all the dots and lines, and perceive at a glance which moves are valid and when one player has won the game. Figure 1 shows a finished game.

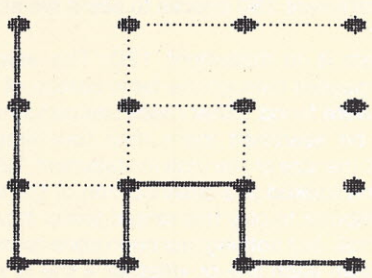

Figure 1. Completed game

Teaching a computer to play this game against a human or merely acting as a referee between two human players is difficult. Drawing the board and using keyboard or joystick to move a cursor and draw a line is fairly simple, but how does the computer check for valid moves, and ultimately determine when one player has won? This is a pattern-recognizing problem, which is child's play for the human mind but difficult for a computer.

One of the first things a programmer must do when attempting to tackle such a problem is to decide on how the information about the game is to be stored inside the computer—a data structure must be chosen. Let's try to set up a scheme that would simply allow the computer to keep track of lines that have been drawn and to determine when a continuous trail exists from the top of the board to the bottom. On a 4-by-4 game board, there are 16 dots and 24 possible lines connecting two dots. Keeping track of which lines have been drawn is fairly easy. We need a 24-element array, one element for each potential line, to indicate which lines have been drawn. If we call this "array L", then L(1) = 1 would mean that the first line has been drawn and L(2) = 0 would indicate that the second line has not been drawn.

Trying to determine if a continuous trail has been drawn from one corner to another is a little more difficult. Each dot can be attached to two, three or four lines and each line can be attached to two dots. One method of trying to attack this problem might be to list all possible ways that a trail could be drawn from one corner of a grid to another. Figures 2a and 2b show the two possible ways a trail could be drawn on a 2-by-2 grid. Figures 2c through 2n show the 12 different ways that a trail could be drawn across a 3-by-3 grid. How many different ways could a line be drawn across a 4-by-4 grid? I don't know, but after looking at the first two cases, I immediately decided that checking all the possibilities was not a very good idea.

Here is a slightly different approach. If we label the dots with capital letters and the lines with lowercase letters as shown

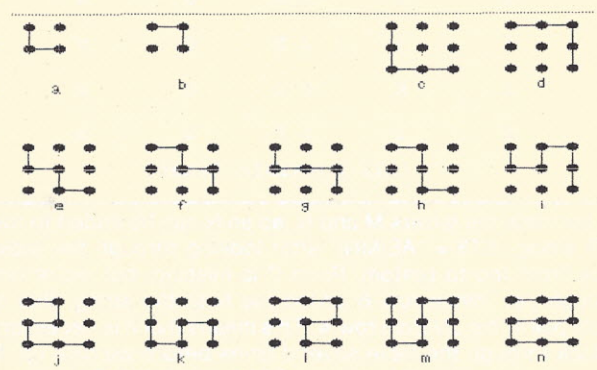

Figure 2. Possible configurations

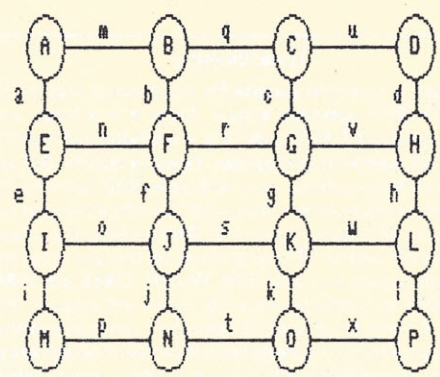

Figure 3. Another variation

in figure 3, we can make up table 1 to show which dots can be connected to each line and the status of the line. If a 1 in the status column indicates a line that has been drawn, we only need to look at the rows that have a 1 in them. Table 2 lists only these rows from table 1.

We want to use the information in table 2 to see if the dots A and P are connected. The dots in two rows of the table are connected by a trail if the same lettered dot appears in both rows. For example, since rows 1 and 2 contain the dot E, the dots A E and I are connected by a continuous trail. In other words, the trail connecting dots A and I goes through dot E. We will save the letters AEI in a string, ST$. If any row of the table contains a letter already in the string, all the letters of that row can be added to the string. If a row does not contain any letters already saved, the letters from that row cannot be added to the string. As we look through the table, ST$ = "AEIM" when we get to the fourth and fifth rows. Since these rows don't contain any of the letters AEIM, they must be skipped. Row

Table 1. Assignment of dots

status	line	dots	status	line	dots
1	a	A E	0	m	A B
0	b	B F	0	n	E F
0	c	C G	0	o	I J
0	d	D H	1	p	M N
1	e	E I	0	q	B C
0	f	F J	0	r	F G
0	g	G K	1	s	J K
0	h	H L	0	t	N O
1	i	I M	0	u	C D
1	j	J N	0	v	G H
1	k	K O	0	w	K L
0	l	L P	1	x	O P

(all possible lines)

Table 2. Rows with a 1

	line	dots
1	a	A E
2	e	E I
3	i	I M
4	j	J N
5	k	K O
6	p	M N
7	s	J K
8	x	O P

(lines actually drawn)

six contains the letters M and N, so an N can be added to the ST$ string. ST$ = "AEIMN" after looking through the table once from top to bottom. Point P is missing, but we're not through yet. When row 6 added the N to the string, that N could pull in the JN from row 4. This means that it is necessary to look through the table several times before we give up. If we go through table 2 four times ST$ = "AEIMNJKOP". Since the string contains both A and P, there is a continuous trail from A to P.

If ST$ is the string, and array L(24) is the status column of table 1 and string array S$(24) is the dots column of table 1, the above algorithm can be translated into a Basic program (see accompanying listing).

The preceding program is written in TRS-80 Disk Basic. Statements 110 and 115 initialize the string ST$. The FOR/NEXT loop in statement number 120 indicates the number of passes through the table. The loop in statement 130 steps through each line of the table. L$ and R$ are the two letters from the current line of the table. Statement 170 will add letter L$ to the string if R$ is already in the string but L$ is not. Likewise, statement 175 will add letter L$ to the string if necessary. Statement 180 checks to see if the string contains an A and a P.

One problem is in statement 120. The example shown required four passes through the table before all the possible combinations were found. Other cases can be found that require the table to be searched more than four times. Can you establish what the size of the loop in statement 120 should be?

We have only looked at a small portion of the logic needed to teach a computer to play this simple game. It can recognize a continuous trail, but nothing has been done to indicate which player has drawn each line or whether a line is a valid move. The game's I/O has also not been approached.

It seems that there should be an easier way for a computer to recognize a continuous trail. If readers care to submit a more elegant solution, we will include it in a later column.□

Program listing

```
100  ST$=""
110  IF L(1)=1 THEN ST$=ST$+"AE"
115  IF L(13)=1 THEN ST$=ST$+"AB"
120  FOR N=1 TO 4
130  FOR M=1 TO 24
140  IF L(M)=0 GOTO 190:  REM THIS LINE NOT DRAWN
150  L$=LEFT$(S$(M),1)
160  R$=RIGHT$(S$(M),1)
170  IF INSTR(ST$,L$)>0 AND INSTR(ST$,R$)=0
     THEN ST$=ST$+R$
175  IF INSTR(ST$,R$)>0 AND INSTR(ST$,L$)=0
     THEN ST$=ST$+L$
180  IF INSTR(ST$,"P") AND INSTR(ST$,"A")
     THEN PRINT "TRAIL IS COMPLETE": END
190  NEXT M
200  NEXT N
```

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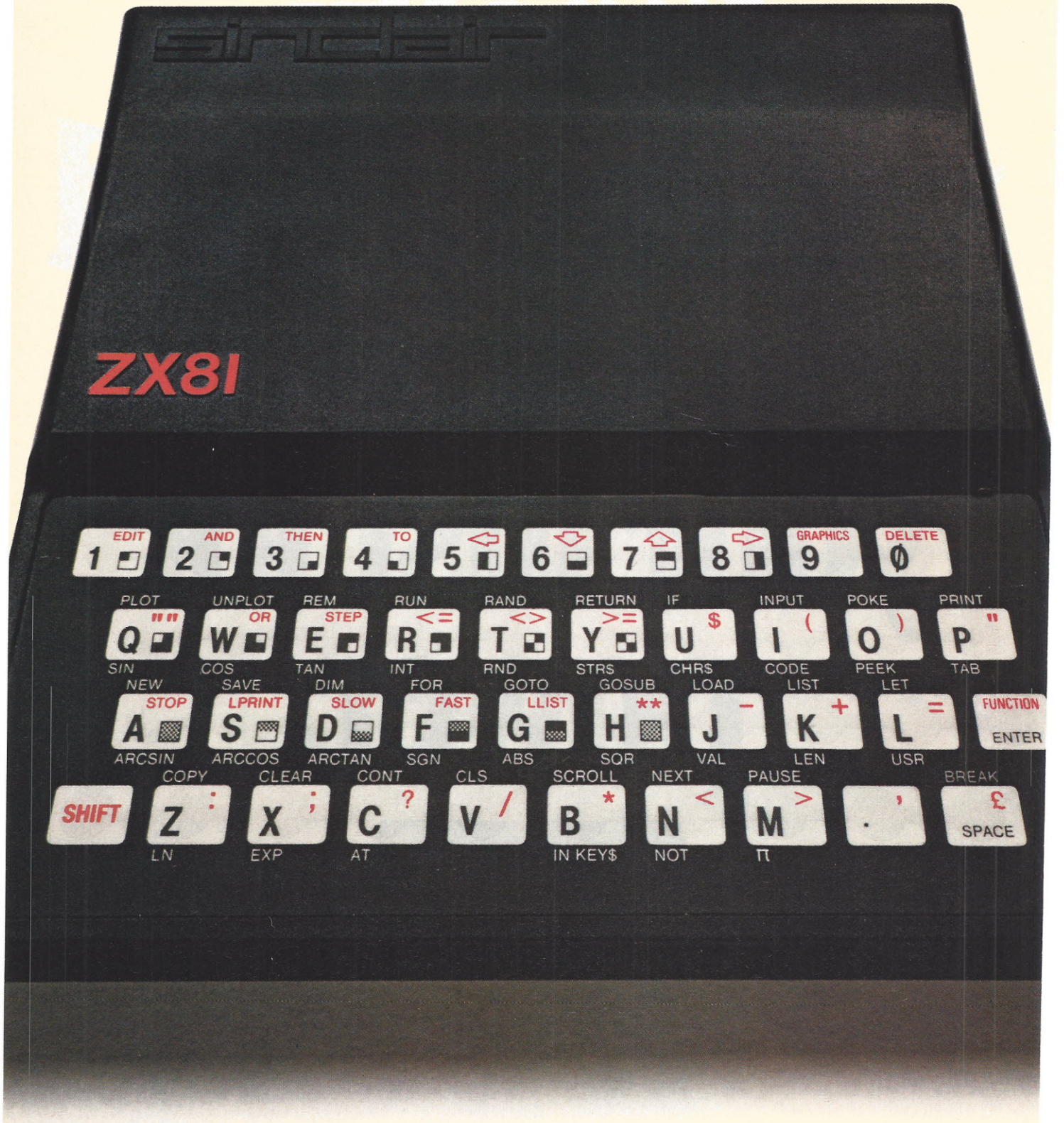
sinclair
ZX81
EDIT 1 AND 2 THEN 3 TO 4 5 6 7 8 GRAPHICS 9 DELETE 0
PLOT Q " UNPLOT W OR REM E STEP RUN R <= RAND T <> RETURN Y >= IF U $ INPUT I (POKE O) PRINT P "
SIN COS TAN INT RND STR$ CHR$ CODE PEEK TAB
NEW STOP SAVE LPRINT DIM SLOW FOR FAST GOTO LLIST GOSUB ** LOAD - LIST + LET = FUNCTION ENTER
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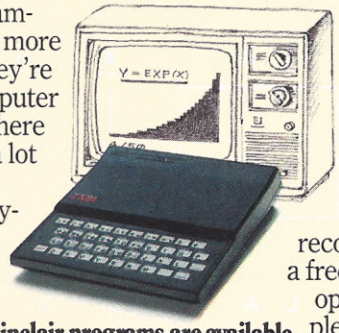

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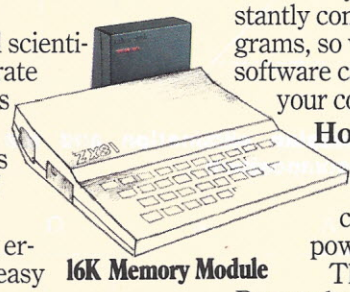

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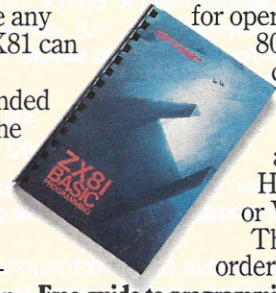

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THE MICRO-MATHEMATICIAN

by Dr. John C. Nash

Orthogonalization—more matrix decompositions

Last month, we considered Gaussian elimination, one of the oldest but still most valuable tools of numerical linear algebra. The elimination process was used to solve sets of n linear equations in n unknowns by judicious use of a sequence of operations in which a multiple of one row of a matrix is added to another row of that matrix.

This month, another application of the same elementary operations—that of computing a set of orthogonal vectors (or one-dimensional arrays)—will be illuminated. The orthogonal vectors are useful in a variety of problem solving situations, particulary for least squares approximations.

An example, given by G. Dahlquist and A. Björck, *Numerical Methods,* Prentice-Hall (Englewood Cliffs, NJ), concerns the calculation of atomic weights for nitrogen and oxygen from the molecular weights of six nitrogen oxides:

NO	30.006 ;	N_2O	44.013 ;	NO_2	46.006
N_2O_3	76.012 ;	N_2O_5	108.010 ;	N_2O_4	92.011

We will solve this problem later. Orthogonalization also forms a part of many other numerical methods, such as the gradient minimization (*IA* Apr 82).

Before launching into the details of the orthogonalization process, it is necessary to recognize how the same elementary operations may be used as building blocks in two quite dissimilar algorithms.

Recall that the elementary row operation may be considered as a multiplication of the matrix to be altered by a transformation matrix, which differs from a unit matrix in only one element. If we are to add s times row i to row k in the matrix to be altered (i assumed to be less than k), our transformation matrix T has $T_{ki} = s$. Note that this element is below the diagonal of the T matrix (see figure 1a). We can show that a product of such transformations—in other words a sequence of elementary row operations on some matrix A—will have no non-zero elements above the diagonal, and is therefore lower triangular. We label this product of transformations L^{-1}, where the choice of the inverse is made to conform with other authors.

If no pivoting is required in the Gaussian elimination method for solving the set of linear equations

$$A\mathbf{x} = \mathbf{b},$$

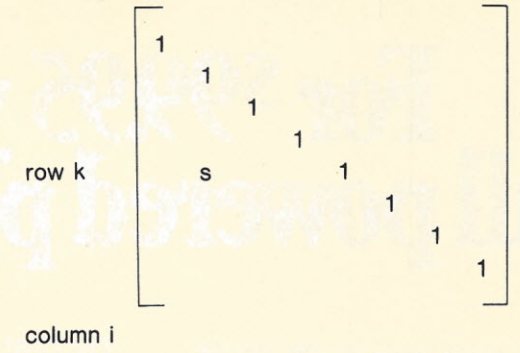
then the result of elimination of all but one unknown is an *upper triangular* matrix U. This is illustrated in figure 1b. The panoramic picture of linear equation solving by Gaussian elimination is therefore

$$L^{-1}A\mathbf{x} = U\mathbf{x} = L^{-1}\mathbf{b} = \mathbf{v}.$$

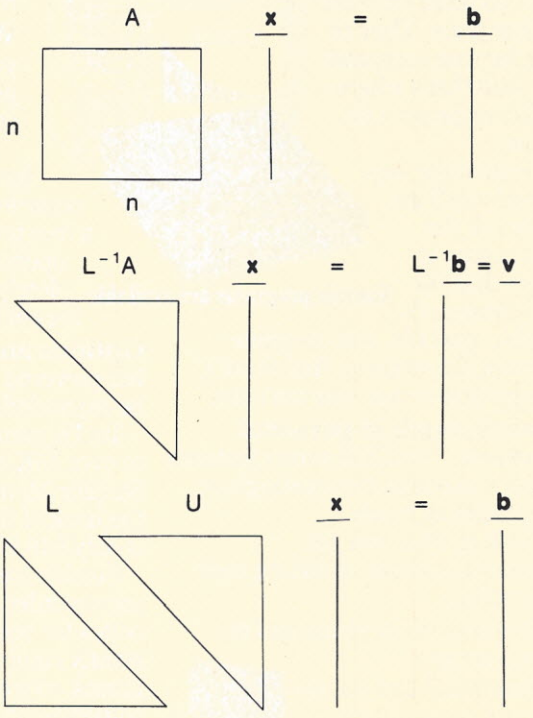
($\mathbf{v}$ is just a name for $L^{-1}\mathbf{b}$.)

Recall that we can now solve the original equations by solving the reduced equations

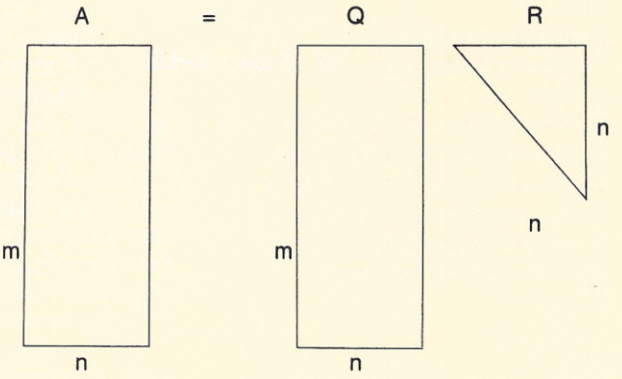
$$U\mathbf{x} = \mathbf{v}$$



a) The elimination matrix T. All elements other than those shown are zero.



b) Gaussian elimination and the LU (triangular) decomposition



c) The QR decomposition of a rectangualr matrix

Figure 1. The geometry of elimination and the QR decomposition

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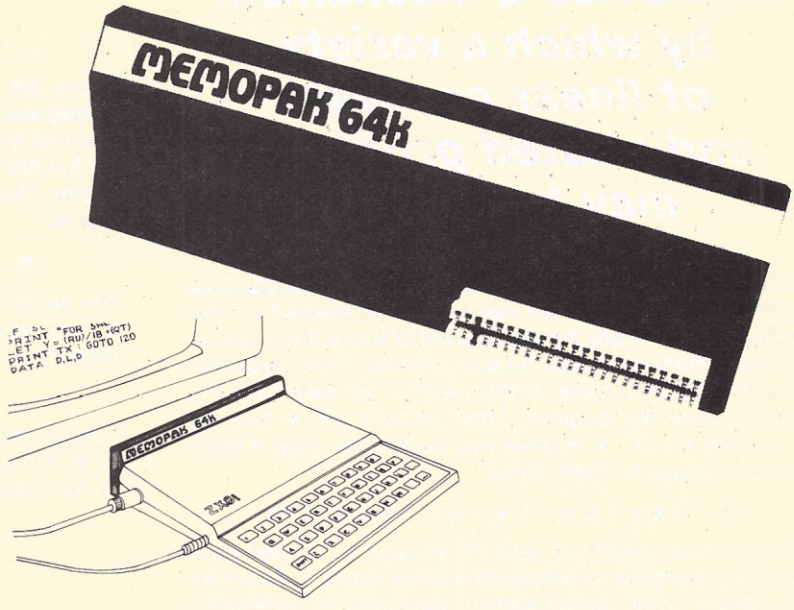

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The goal is to provide a mechanism by which a variety of linear equation and related problems may be solved.

by back-substitution, or we can use more elementary row operations to eliminate the elements of U above the diagonal. The transformation matrices for such a Gauss-Jordan reduction (to use the common name for this method) will each have one element above the diagonal. Their product will, in fact, be U^{-1}, so that $\mathbf{x} = U^{-1}\mathbf{v}$. Another way to write the original equations now presents itself, since

$$L\,L^{-1}\,A\,\mathbf{x} = L\,U\,\mathbf{x} = L\,\mathbf{v} = L\,L^{-1}\,\mathbf{b} = \mathbf{b} = A\mathbf{x}.$$

Thus we can identify A with the product (L U), and have achieved a triangular *decomposition* of the matrix A. There are many variants of this decomposition, depending on the ordering of the calculations, choices of scaling factors for the diagonal elements of U and L, and the ways in which pivoting is incorporated. The goal of all of them is to provide a mechanism by which a variety of linear equation and related problems may be solved. Furthermore, it should be noted that the inverse of the matrix A (that is A^{-1}) is in general a much less useful tool for calculation purposes than the decomposition.

Orthogonalization can also be seen as a matrix decomposition. If the vectors to be orthogonalized are called $\mathbf{a}_1, \mathbf{a}_2, \ldots, \mathbf{a}_n$, and each of them has m elements (components), they may be collected into the rectangular matrix A, which is now m by n. That is,

$$\mathbf{a}_j = (A_{1j}, A_{2j}, A_{3j}, \ldots, A_{mj})^T$$

where the ^{T} denotes matrix transpositin. The Gram-Schmidt orthogonalization was previously presented here (*IA* Apr 81) as a tool for computing search directions in a gradient method for function minimization. This took $\mathbf{a}_1$ as the first orthogonal vector. Usually, this is normalized so that it has unit length, that is,

$$\mathbf{q}_1 = \mathbf{a}_1 / R_{11} \text{ where } R_{11} = \text{SQRT}\,(\mathbf{a}_1^T\,\mathbf{a}_1).$$

The second orthogonal vector is formed by subtracting from $\mathbf{a}_2$ any component in the direction of $\mathbf{q}_1$. Inclusion of the normalization in the process allows us to write this as

$$R_{22}\,\mathbf{q}_2 = \mathbf{a}_2 - (\mathbf{q}_1^T\,\mathbf{a}_2)\,\mathbf{q}_1$$

Note that this is not one but m equations, since it applies to all the elements of each vector. The general, or i'th step of the orthogonalization is

$$R_{ii}\,\mathbf{q}_i = \mathbf{a}_i - \sum_{j=1}^{i-1} (\mathbf{q}_j^T\,\mathbf{a}_i)\,\mathbf{q}_j \qquad (1)$$

with R_{ii} being the normalization factor needed to render $\mathbf{q}_i^T\,\mathbf{q}_i = 1$. If the contribution of $\mathbf{q}_j$ within the original $\mathbf{a}_i$ is removed by subtracting $(\mathbf{q}_j^T\,\mathbf{a}_i)$ times column j of the matrix of vectors to be orthogonalized from column i of the same matrix, we can use elementary column operations. Furthermore, since $\mathbf{q}_k^T\,\mathbf{q}_j = 0$ for $k \neq j$ (after all, the q-vectors are supposed to be orthogonal), we can still calculate $(\mathbf{q}_j^T\,\mathbf{a}_i)$ from the transformed i'th column

$$\mathbf{a}_i' = \mathbf{a}_i - (\mathbf{q}_k^T\mathbf{a}_i)\,\mathbf{q}_k.$$

That is, mathematically,

$$\mathbf{q}_j^T\mathbf{a}_i' = \mathbf{q}_j^T\mathbf{a}_i = R_{ji} \qquad \text{(for i greater than j).}$$

However, $\mathbf{a}_i$ has a larger norm than $\mathbf{a}_i'$. and the rounding error made in calculating $(\mathbf{q}_j^T\mathbf{a}_i')$ will usually be greater than that made in calculating $(\mathbf{q}_j^T\mathbf{a}_i')$. This suggests that the elements of R (which are the values used in each elimination operation) be generated row by row, that is, the contribution of $\mathbf{q}_j$ is subtracted from every vector in the set to be orthogonalized before $\mathbf{q}_{j+1}$ is computed. The traditional Gram-Schmidt process develops R column by column, that is, the contributions of all orthonormal vectors so far obtained are subtracted from $\mathbf{a}_i$ in one operation to generate $\mathbf{q}_i$. Mathematically, the results are the same; computationally, the row-wise method may be more stable. Either way, we have a decomposition

$$A = Q\,R$$

where Q is m by n and orthogonal so that $Q^T\,Q = 1_n$, an n by n unit matrix, and R is upper or right triangular.

The Modified Gram-Schmidt orthogonalization algorithm is then as follows:

1) For i = 1 to n. (n is the number of vectors of length m to be orthogonalized).
2) Let $R_{ii} = \text{SQRT}\,(\mathbf{a}_i^T\,\mathbf{a}_i)$ using current $\mathbf{a}_i$. If R_{ii} is small, stop.
   Let $\mathbf{q}_i = \mathbf{a}_i / R_{ii}$.
3) For j = i + 1 to n (omitted for i = n)
   Let $R_{ij} = (\mathbf{q}_i^T\,\mathbf{a}_j)$ where the current $\mathbf{a}_j$ is used.
   Let $\mathbf{a}_j = \mathbf{a}_j - R_{ij}\mathbf{q}_i$.
   End loop on j.
4) End loop on i.

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In the above, the vector inner products are defined by equations such as

$$(\mathbf{q}_j^T \mathbf{a}_i) = \sum_{k=1}^{m} q_{kj} a_{ki} .$$

This algorithm can be further stabilized by pivoting on the columns. Instead of taking the next vector in sequence (the current $\mathbf{a}_i$) as the one to define the i'th orthogonal vector, we could choose the vector with the largest norm among those remaining. This ensures that attempts to orthogonalize linearly dependent sets of vectors do not fail to find all the available orthogonal directions because one of the norms R_{ii} becomes very small. With linearly dependent vectors, the elimination process will cause one or more of the vectors to become null, or at least very nearly so. Such vectors cannot be normalized without causing severe rounding errors or a zero-divide condition. Another way to state the existence of the linear dependency is to say that the rank of the m by n matrix A is less than either m or n.

Column pivoting is relatively messy to program, so I will not present code to implement it here. There are other methods to provide QR decompositions that give less complicated programs. The Basic code in listing 1, together with the elimination subroutines of last month's column, are designed to work on problems that have full rank—that is, linearly independent sets of starting vectors to orthogonalize.

The QR decomposition allows us to solve least squares approximation problems of the type previously presented. In carrying out this solution, we suppose that the molecular weight of a compound is the sum of the atomic weights of its elements taken in proportion to the number of atoms of each element in the compound. We therefore organize the data as follows: (the compounds are in order NO, N_2O, NO_2, N_2O_3, N_2O_5, N_2O_4)

$$A = \begin{pmatrix} 1 & 1 \\ 2 & 1 \\ 1 & 2 \\ 2 & 3 \\ 2 & 5 \\ 2 & 4 \end{pmatrix} \qquad \mathbf{b} = \begin{pmatrix} 30.006 \\ 44.013 \\ 46.006 \\ 76.012 \\ 108.010 \\ 92.011 \end{pmatrix}$$

Letting $\mathbf{x} = (x_1, x_2)^T$, where x_1 = atomic weight of nitrogen and x_2 = atomic weight of oxygen, gives the least squares problem of minimizing the sum of squared residuals

$$\mathbf{r} = \mathbf{b} - A\mathbf{x}$$

with respect to the parameters $\mathbf{x}$. The sum of squares may be written as $\mathbf{r}^T\mathbf{r}$, which is simply a vector inner product. Traditional calculus applied to minimizing the sum of squared residuals yields the normal equations

$$A^T A\mathbf{x} = A^T\mathbf{b}.$$

Use of the QR decomposition in a direct substitution into the normal equations gives

$$R^T Q^T Q R\mathbf{x} = R^T R\mathbf{x} = R^T Q^T\mathbf{b}$$

Since R has no zero elements on the diagonal if the orthogonalization has been successful, the R^T can be "divided out" (it is non-singular, so the inverse of R^T exists), leaving

$$R\mathbf{x} = Q^T\mathbf{b} = \mathbf{y}$$

Since R is triangular, these last equations are easily solved by back-substitution. The results of applying this method to the problem above is given in listing 2. Interested readers are urged to try different examples and in particular to observe the behavior of the method when presented with linearly dependent vectors.□

Program on page 148

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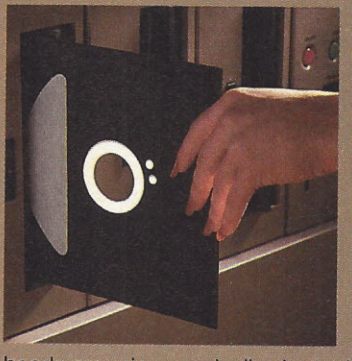

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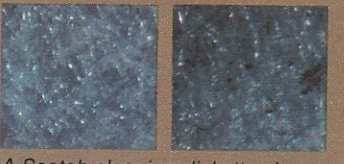

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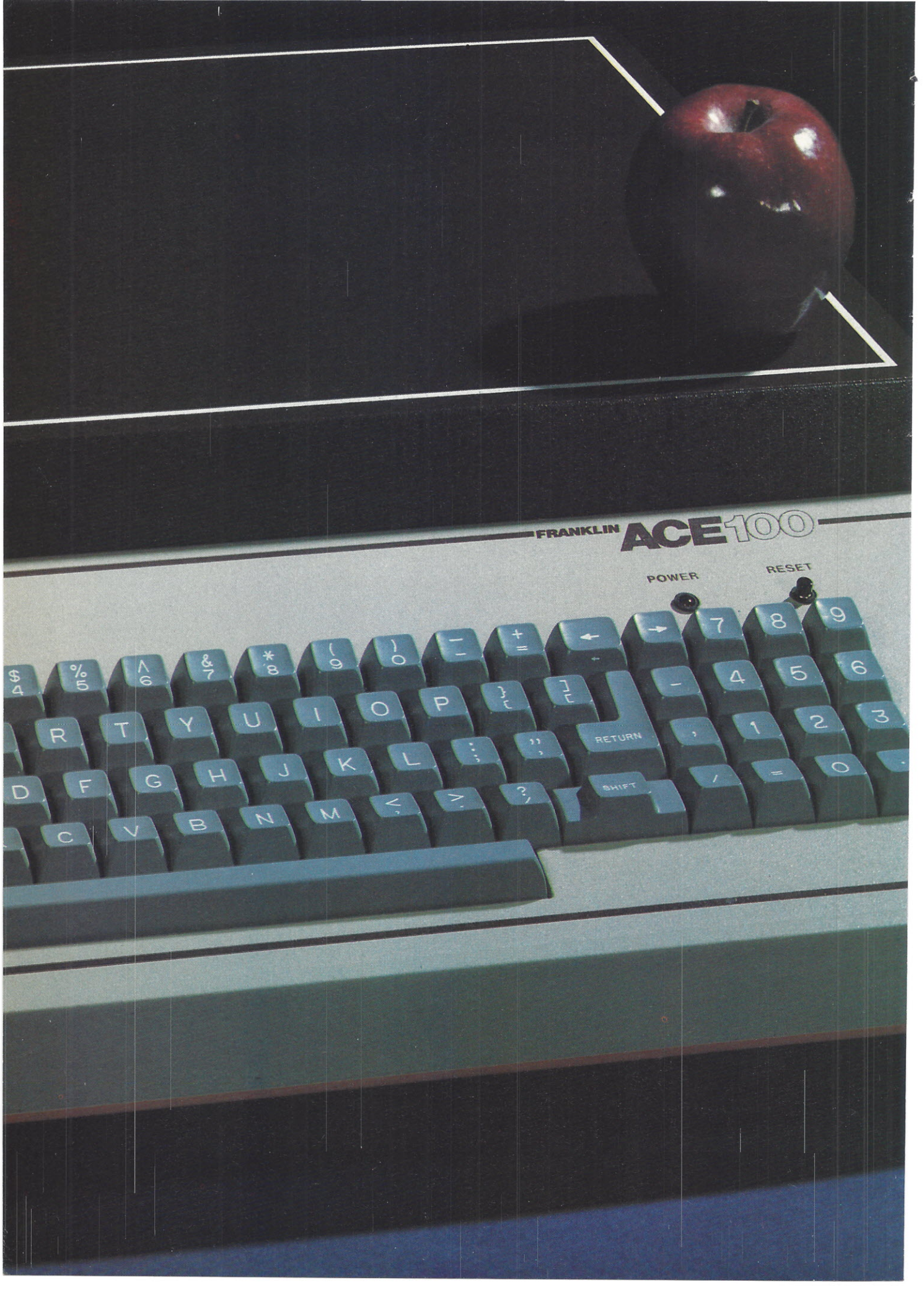
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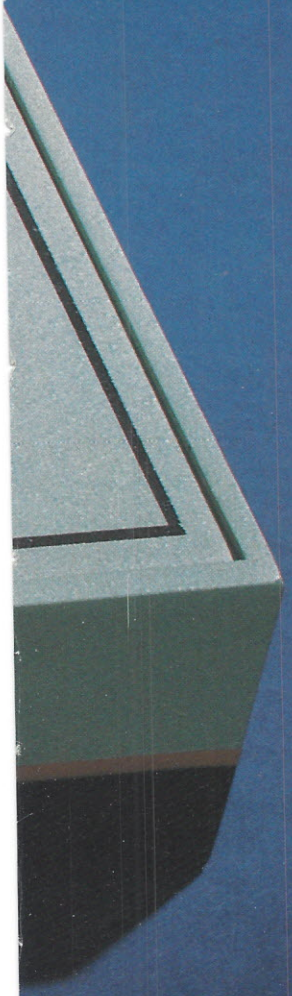

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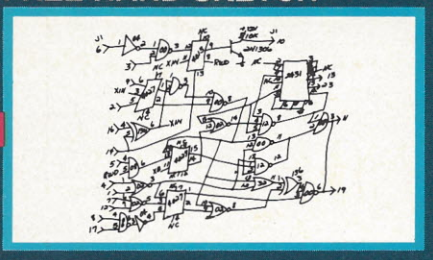
CIRCLE INQUIRY NO. 36

DRAFTING SYSTEM 1

The World's Leader in Computer Schematics and Automatic Data Base Preparation

FREE-HAND SKETCH



"DS1" allows operator to digitize directly from a free-hand sketch. Vocal Output prompts operator as IBM Microcomputer collects data. Enter a "D" size in 1 hour. NO GRIDS. EDITS are performed in minutes.

COMPUTER PROCESSING

HP1000
DG Nova 4X, Eclipse, MV 8000
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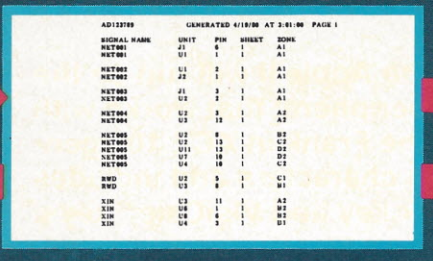
Computer straightens slanted lines, uses correct size symbols and enters alignments among symbols entered by user during input. Drum plotter or Electrostatic plotter output.

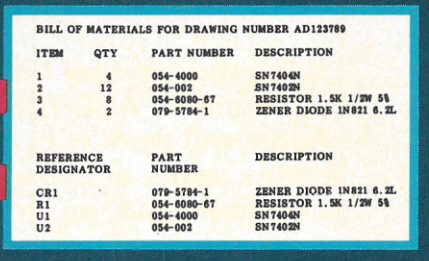
CONNECTION NET LISTING



AD123789 GENERATED 4/18/86 AT 3:01:06 PAGE 1

SIGNAL NAME	UNIT	PIN	SHEET	ZONE
NET001	J1	6	1	A1
NET001	U1	1	1	A1
NET002	U1	2	1	A1
NET002	J2	1	1	A1
NET003	J1	3	1	A1
NET003	U2	2	1	A1
NET004	U2	3	1	A2
NET004	U3	12	1	A2
NET005	U2	8	1	B2
NET005	U2	13	1	C2
NET005	U11	13	1	D2
NET005	U7	10	1	D2
NET005	U4	10	1	C2
RWD	U2	5	1	C1
RWD	U3	8	1	B1
XIN	U3	11	1	A2
XIN	U8	1	1	B2
XIN	U8	4	1	B2
XIN	U4	3	1	B1

BILL OF MATERIALS



BILL OF MATERIALS FOR DRAWING NUMBER AD123789

ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	054-4000	SN7404N
2	12	054-002	SN7402N
3	8	054-6080-67	RESISTOR 1.5K 1/2W 5%
4	2	079-5784-1	ZENER DIODE 1N821 6.2L

REFERENCE DESIGNATOR	PART NUMBER	DESCRIPTION
CR1	079-5784-1	ZENER DIODE 1N821 6.2L
R1	054-6080-67	RESISTOR 1.5K 1/2W 5%
U1	054-4000	SN7404N
U2	054-002	SN7402N

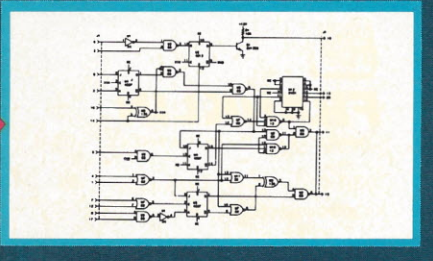
"DS1" automatically provides Net and Bill Lists directly from data base of digitized schematic.

P.C.B. ROUTER INTERFACES

ASI-PRANCE
AUTOMATE '80
COMPUTERVISION
REDAC
SCICARDS™
others available

"DS1" interfaces to P.C.B. Routers, Wire Wrap, Simulation and Test Programs.

UPDATED SCHEMATIC



"DS1" performs Back-Annotation from a "Was-To" list derived from the P.C. Router. "Back-Annotation" automatically updates the schematic to agree with the circuit board component placement.

DESIGN AIDS inc.

CIRCLE INQUIRY NO. 25

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Learning with Micros

by Michael A. Burke and Robert G. Patton

Summer Computer Camp

Twenty-five public and private school teachers spent two weeks of their 1981 summer vacation attending a unique camp. Held at Mukwonago High School (Mukwonago, WI), it was designed to provide elementary and secondary teachers with ten days of hands-on computer experience. The camp was the first phase of a federally-funded ESEA Title IV-C Project approved by the Wisconsin Department of Public Instruction. Primary objectives were to expose area teachers to microcomputer application in the classroom and to enhance their understanding of microcomputers' role in society.

Campers were guided through various learning activities by counselor Jerry Kaiser, and two student assistants. Twelve Apple II Plus (32K- and 48K-byte) microcomputers, combined with a staff/participant ratio of 5 to 1, comprised a hands-on learning environment for camp participants. Activities were designed to enable evaluation of computer software programs, writing of computer-assisted instruction programs for classes, and development of lesson plans for teaching computer applications.

The project's second phase began in the fall, when the microcomputers purchased with the federal funds were placed in the district's elementary schools. Teachers attending the camp rated the use of computers highest as a teaching tool to provide drill and practice of "basic skills." However, each left the camp with independent ideas on implementation.

Attitudes change dramatically

An attitude survey was given to 25 participants on the first and last days of the camp. The questionnaire was used to measure change in attitudes. In general, stances transformed from either no opinion or apathy to firm convictions. For example, on the statement, "Computers will improve health care," 32% of the participants either had no opinion or disagreed on the first day. At the end of the session, no one disagreed with the statement and only 8% had no opinion.

On two questions dealing with computer error, there was a dramatic change of feeling. On the first day, 52% disagreed with the statement "Computers make mistakes at least 10% of the time." By the last day, 92% disagreed with the statement. Initially, 20% of the participants strongly agreed that programmers and operators made mistakes and computers are mostly error-free. On the last day, 56% were convinced that the programmers were at fault.

The feelings toward how computers will influence the world of work were more intense at the end of camp. Perceptions reflected less intimidation—96% of the respondants came to feel that the computer is a tool just like a hammer or lathe. 68% of the participants considered computers best suited to repetitive or monotonous tasks. 92% assume computers will replace low skill jobs and create jobs needing specialized training. 96% felt the computer would create as many jobs as it would eliminate.

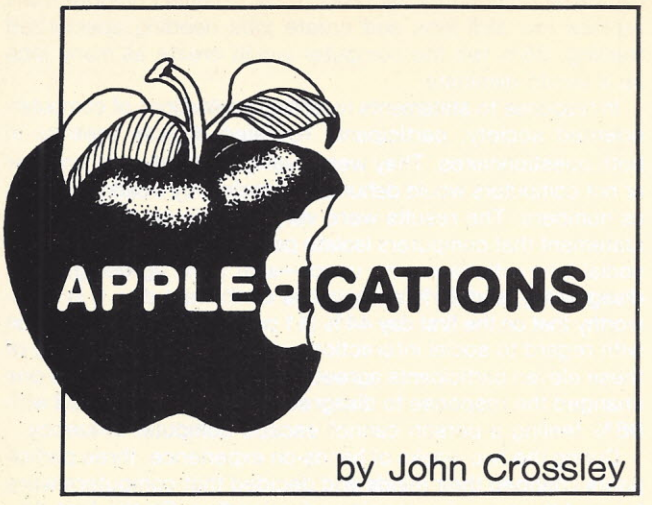
In response to statements regarding implications of computer-oriented society, participants revealed diverse feelings in both questionnaires. They were evenly split between whether or not computers would dehumanize society by treating humans as numbers. The results were very close in response to the statement that computers isolate people by preventing normal social interactions among users—with 36% agreeing, 44% disagreeing, and 20% no opinions on the last day. It is noteworthy that on the first day 44% (11 participants) had no opinion with regard to social interaction, while on the last day five of these eleven participants agreed with the statement, while one changed the response to disagree. Camp was adjourned with 96% feeling a person cannot escape computer influence.

During the two weeks of hands-on experience, three participants changed their minds and decided that computers were beyond the typical person's understanding. On the first day, one person felt this way; at the end of the sessions, four expressed this belief.

Among this group of 25 teachers, five have since enrolled in computer classes at area colleges to further programming knowledge.

Participants interviewed at the end of the session indicated that they had a better understanding of the role of microcomputers in our changing society and the importance of educating our students to use computers effectively.□

Michael A. Burke is Co-ordinator of Instructional Resources for Mukwonago Area Schools. Robert G. Patton is a computer teacher at Homestead High School in the Megaon-Thiensville School District, WI.



by John Crossley

Controlling your Input

One of the things that marks a well-written program is how it handles user input. Applesoft has two statements for getting data into the computer, INPUT and GET. These are both useful but neither allow you much control of the format of the data being entered.

The INPUT statement requests one line of characters from the current input device. A line is always ended with a carriage return. Applesoft uses the input routines in the Apple's Monitor ROM and shares their features and limitations. It allows the use of the left-arrow key to back over text to correct errors, the right-arrow to take characters from the screen and put them into the input buffer, and the editing commands activated by the ESCape key.

The monitor subroutines limit the input buffer to 255 characters. Applesoft does some post processing of the input buffer, ignoring any characters past the 239th. When the 256th character of the line is typed, the monitor will beep, print a backslash and do a carriage return. There's no warning when Applesoft truncates the input buffer to 239 characters.

INPUT responds strangely to certain characters. A control-C will stop execution of the program if it is the first character in the string. Commas and colons are seen as delimiters between values in multiple variable INPUT statements. For example, Cupertino, CA is seen as two input strings, Cupertino and CA, and the user will usually get an ?? EXTRA IGNORED if there was only one variable in the input statement. INPUT also strips the leading spaces from the string.

Pressing the ESCape key in response to an INPUT will put the monitor routines into edit mode. The edit commands allow the user to move the cursor anywhere on the screen or erase all or part of the screen. There is no way to tell if you are in this mode or not. The edit mode can be used to change what was typed in, but the user must then copy over the rest of the string because the monitor routines will ignore everything after the carriage return.

Confusing statements

INPUT can request multiple variables, usually separated by commas. If only one is typed in, the user will see a ?? and a cursor on the next line. This is Applesoft's cryptic way of saying "I want more values." If the INPUT statement is asking for a numeric input and the user types in anything else, he gets a ?? RE-ENTER and another cursor on the next line. This, of course, means "I want numbers, not strings." In both cases the user is left somewhat bewildered.

Obviously, the INPUT statement isn't too friendly. It can easily confuse the non-programming user. INPUT doesn't give the programmer any control of the screen format either. This lack of format control means that the user can type in strings that are so long that important information is scrolled off the top of the screen.

The GET statement will put a cursor on the screen and return one character. GET will put a blinking cursor on the screen but won't echo the typed character on the screen. GET doesn't stop on a control-C or treat ESCape as special. GET can have unexpected results if the user types in a control-@. GET will return a nul string if control-@ is typed in. GET gives the programmer control but doesn't do more than get one character.

The accompanying program contains a subroutine that gives the programmer complete control of what characters and how many characters are acceptable. The only editing allowed is to erase the last character typed. The erased character is removed from the screen to avoid confusion. Each character is read from the keyboard with a GET statement, then the resulting character is checked to see if it is all right to keep. Characters that are acceptable will be added to RE$. No characters will be added to RE$ if RE$ is already as long as the length variable specifies. There are two parameters required to use this subroutine. They are OK$ and LN.

. . . the user can type in strings that are so long that important information is scrolled off the top of the screen.

OK$ describes the set of acceptable characters. The format for OK$ is a list of pairs of characters defining the limits in ASCII order. For example: 09AZ. . is interpreted as the numerals 0 through 9, the letters A through Z, and the period character. This allows the programmer to control what is typed in. Characters not allowed by OK$ will be ignored. LN is the maximum number of characters allowed. Any characters typed past that limit will be ignored.

The subroutine assumes the prompt has already been sent to the screen and the cursor is positioned for the first typed character. It then fills the next LN character positions with underlines to show exactly how much room is available for typing an answer. The underlines are replaced when the user types the backspace key. All of the remaining underlines are replaced by spaces after the user ends the line with a carriage return. The result will be RE$. The VAL function can be used to convert RE$ into a numeric value. The only variables that are changed by this routine are A$, A, A1 and RE$.

Line 10020 is the line that clears the input field on the screen and fills it with underlines. This indicates how much longer the input can be. The underline character is the CHR$ (95) and it can be changed to any character the programmer wants. Be sure if you change it here that you also change it in line 10070 to match, otherwise there will be a trail of underlines behind the cursor after *any* backspacing.

Lines 10040 and 10060 add the character in A$ to RE$ if the character is on the acceptable character list (OK$) and there is room in RE$. They also handle printing the accepted character on the screen.

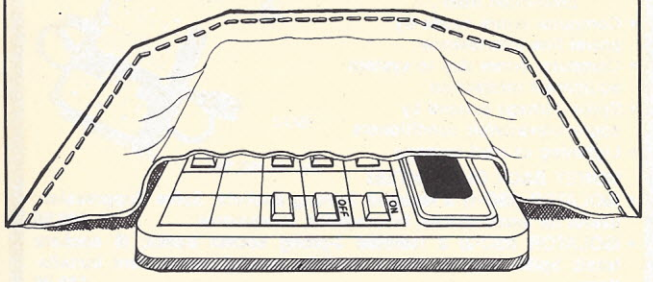
Line 10070 handles the backspace character. It checks to be sure that there is something in RE$ to remove and removes it. This line also backs up the cursor and writes an underline at the new cursor position. □

Program listing

```
10  HOME
15  VTAB 4
20  PRINT "DESCRIPTION:";
25  OK$ = "  09AZ"
30  LN = 10
35  GOSUB 10000
40  DE$ = RE$
45  VTAB 6
50  PRINT "QUANTITY   :";
55  OK$ = "09"
60  LN = 2
65  GOSUB 10000
70  IF  VAL (RE$) = 0 THEN END
75  VTAB 10 : PRINT VAL (RE$);" ";DE$;"'S"
85  GOTO 15
10000  REM  INPUT ROUTINE
10010  RE$ = ""
10020  A1 =  PEEK (36): FOR A = 1 TO LN:
       PRINT CHR$ (95);: NEXT : POKE 36,A1
10030  GET A$
10040  FOR A = 1 TO  LEN (OK$) - 1 STEP2
10050 : IF  LEN (RE$) < LN AND A$ > =
        MID$ (OK$,A,1) AND A$ < = MID$
        (OK$,A + 1,1) THEN RE$ = RE$ + A$:
        PRINT A$;
10060  NEXT A
10070  IF A$ =  CHR$ (8) AND  LEN (RE$) >
       0 THEN RE$ =  MID$ (RE$,1, LEN (RE$)
       - 1): PRINT A$;CHR$ (95);A$;
10080  IF A$ < > CHR$ (13) THEN 10030
10090  IF  LEN (RE$) < LN THEN  FOR A =
       LEN (RE$) TO LN: PRINT " ";: NEXT
10100  PRINT
10110  RETURN
```

POWER IN YOUR POCKET

by Bob McElwain



Decision-making Tools

The selection of analytical tools available to a large business is awesome. Linked with massive computing power, these tools give big business yet another competitive edge over small business. Yet virtually every decision in smaller-scale ventures is critical. Correspondingly, the need for good decision-making tools is greater—not less. Big business can often bury mistakes with good accounting.

The advent of affordable computing has given the small businessman the opportunity to emulate big-business methods. Since in most cases no data processing staff is available, the individual businessman must bear the burden of implementing these methods.

The inexpensive handheld computers from Sharp, Radio Shack or Casio offer an opportunity to explore the use of analytical tools before investing in a more powerful system.

Following is a program to determine the breakeven point on an inventory purchase and predict profits. With such an elementary program, one might question what's to be gained by writing it. A calculator could provide the same results. Perhaps the program would conserve a bit of time, but this saving might not equal the time required to write the program.

A principal merit of using any computer is to provide management control of procedures. Management can dictate procedures by incorporating them into a program. Whenever the program is run, results will be determined by the program design. On a smaller scale, a pocket computer enables you to do all your careful thinking one time only.

Subsequent use of the program can be an almost no-think operation. The results will be consistent. For example, there's no chance of dividing accidentally by the wrong number—as can happen with a calculator.

The accompanying program accepts quantity purchased and sold and the cost and price for a given item. It then computes the quantity of sales required for breakeven and the final profit. Entry of the quantity purchased and sold is accumulated along with cost and prices. An average cost and price/unit is computed. From these results and an estimated future price, the breakeven point and final profit are determined.

You might choose to use the program even before making a purchase—it can be viewed at any time in the sales cycle to monitor progress. Results might lead you to a future sales price adjustment.

The program can easily be tailored to fit your particular needs. For example, if you keep your records as quantity and total cost, adjust the input statements and computation accordingly. If the cost of warehousing goods is critical or the cost of money used for purchses is significant, these factors can be added. (See this column, *IA* Dec 81.)□

Variables used

I$ = Temporary value.

P = Printer flag: one if printer will be used, otherwise zero.

Q = Accumulated quantity sold.

R = Accumulated total sales.

S = Accumulated total cost.

T = Accumulated total number of items.

W = Adjusted quantity remaining.

X = Expected future price.

Y = Temporary value.

Z = Temporary value.

Program listing

```
5: PRINT "PROFIT"
    - Note that CLEAR will set all
      values to zero and therefore can
      be used in place of the follow-
      ing statements.  Set Q for accum-
      ulation of quantity sold.
10: Q=0
    - Set R for accumulation of total
      sales.
```

Continued on page 150

The MultiMode Printer with The Magnificent Fonts

MultiMode Printer Offers Flexibility

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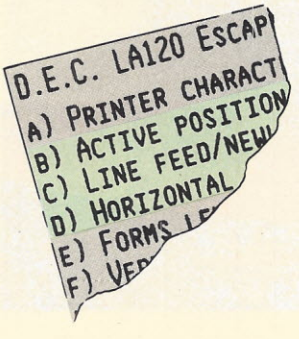

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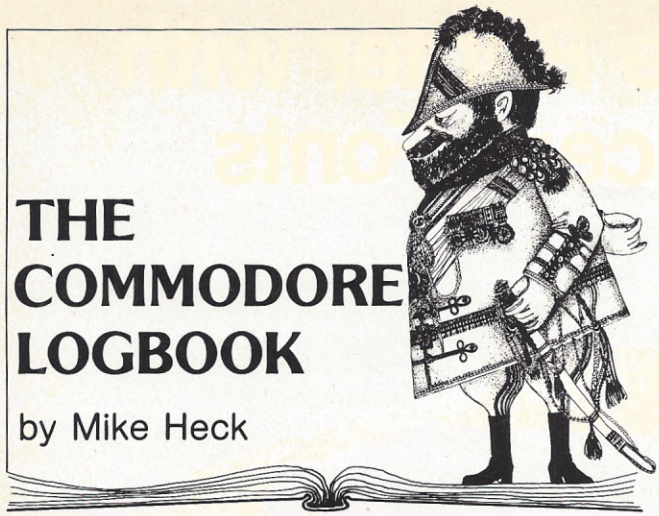

THE COMMODORE LOGBOOK

by Mike Heck

Utility Software Releases

While many of us tend to use pre-written software programs, few people have abstained entirely from at least trying to write a custom application or modify an existing package. Most know the frustration of tracking a program's flow in order to debug or change it. Once a program is written, transferring it from one machine to another can be a major chore. In the process of experimentation, users often accumulate a fair number of diskettes and have no idea of what programs are on which disk —or what these programs do.

Human Engineering Software (Los Angeles, CA) markets a number of useful utility programs for the full range of Commodore systems. They are designed to make day-to-day operation and program development run smoother.

Two of the programs, Hescount and Heslister, are essential for anyone doing serious programming. These programs follow program flow and unscramble cryptic looking listings. Hescom allows rapid program transfer from any Commodore system to another via a direct connection. Hescat is a diskette cataloging system that provides the means for organizing your disk library. Versions are supplied for the Vic-20 and the Pet/CBM with any level Basic ROMs, contributing to the software's versatility.

Those who have been building a software library for some time know how hard it is to find a particular program in the midst of hundreds of programs—usually scattered among many diskettes. Hescat is comprised of a number of programs tied together under one main menu.

The task of cataloging all your disks is handled by the CATALOG command.

SORT NAMES creates an alphabetical index of every file name. It indicates what type of file it is (Program, Sequential, User, or Relative), sifting through about 1,700 filenames in under one second. SORT NAMES automatically chooses from two different techniques for optimal speed—one if the file was already cataloged and another if it was just added.

Reports to the printer are directed by PRINT. Instructions permit use with any printer; code is supplied to work with Commodore, Epson MX-80 and Base-2 printers.

Perhaps the most useful program is LOCATE. It searches through the alphabetized file created by SORT NAMES to find a full or partial filename. For example, SORT would match filenames SORT, SORTED and QUICK-SORTER. A wild card character, ?, can be placed in the search string, so T?N would match TOP TEN, TIN, and GROSS TONNAGE. This expedient search is also accomplished by fast machine code.

All Hescat programs are written with error-handling routines and are well-engineered. A user manual of almost 50 pages is provided, which also includes well-commented listings of all the programs.

To use Hescat, load the program from the supplied disk. The main menu will appear, with numbered options for all the tasks previously described. The first step is to catalog all your disks, using option #1. Each disk is placed in drive 1. Hescat will then

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- Adjustable Printhead/1-6 Copies
- 96 ASCII Character Set
- Cartridge Ribbon
- 132 Column Print Width
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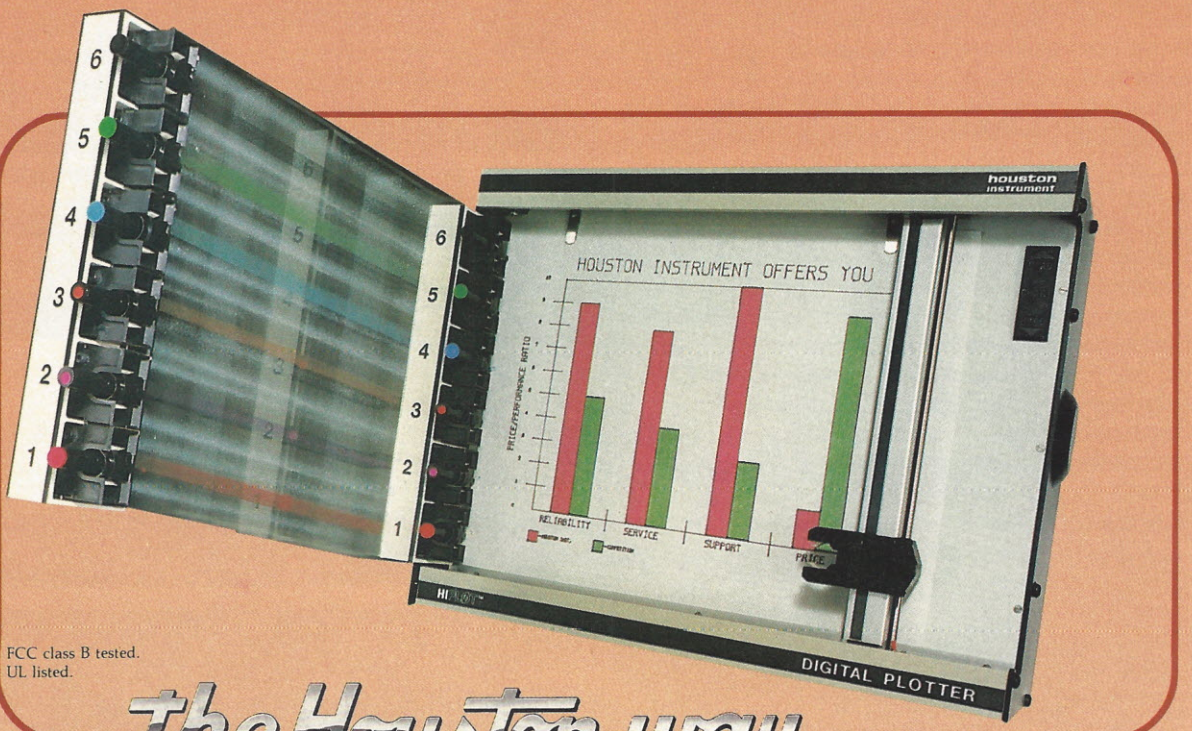

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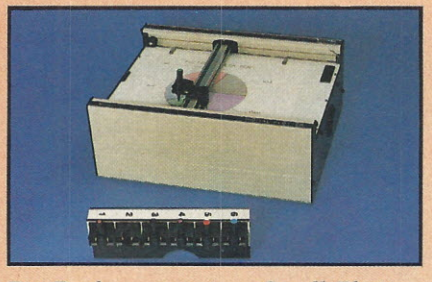
The new HIPLØT DMP Series 6-pen option makes high performance multi-pen plotting affordable. It's available on the DMP 2, 3, and 4 models in the HIPLØT family so you can enjoy the advantages of multi-colored plots on 8½″ × 11″ (DIN A4) surfaces. Of course, you also get the standard HIPLØT range of capabilities such as intelligence, controls, interfaces and resolutions. There's a model for virtually every plotting application.



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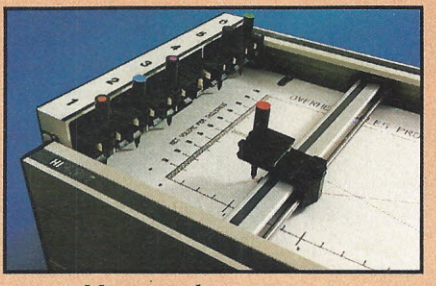

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CIRCLE INQUIRY NO. 47 FOR LITERATURE
CIRCLE INQUIRY NO. 48 TO HAVE A REPRESENTATIVE CALL

prompt for an external disk number. For example, your first disk would be #01, and so on. This allows you to request a particular program later using the Locate option. After all the disks are cataloged, the SORT NAMES option can be utilized. Subsequently, the PRINT option will produce three types of reports: an alphabetized list of all filenames, a summary listing of each disk or a list of all filenames. Each is grouped by disk.

Besides printed reports, the Locate option will display all the matches for the filename entered. When filenames are found, they are shown on the screen and the display can be frozen and resumed at the operator's convenience. The filenames can be loaded directly into memory or the search can be prescribed to the file on the disk.

Hescat can catalog from 3,300 to over 6,000 filenames from as many as 120 diskettes on a Commodore 2040/4040 disk drive. On a CBM 8050 disk, 10,000 to over 20,000 filenames can be cataloged from 210 disks. Hescat requires a minimum of 16K bytes of memory and any dual disk unit.

Hescount can monitor execution of any Basic program. As a program runs, the program accumulates data on executed lines. When it is done, Hescount provides the number of times each line was executed. These counts facilitate debugging and program optimization. One can determine how many times a program looped, and how many times each IF statement was true or false. Lines that were never executed may even be found.

Use of Hescount is straightforward. After initial loading and typing RUN, Hescount is placed in upper memory and protected from Basic. It then displays the appropriate memory location to jump to for eventual execution by using the Basic SYS command. The next step is to load the Basic program and type the proper SYS code (this is the location displayed when first running Hescount and toggles the program). The Basic program is then run normally. Upon completion, SYSO is typed once more for Hescount to clean things up.

The number of times each line was executed will now be stored in an array (UQ%). The supplied documentation contains a number of two- and three-line Basic routines to display the contents of the array on the screen or printer and save the data for later analysis.

Note the accompanying sample in listing 2. Lines 70 and 80 were never executed. Line 70 contains a syntax error but will not be noticed by Basic, because Basic only checks lines when they are executed. Hescount points out lines that were never executed so you can examine them closely or get them to execute. In the example, debugging may appear easy because the values are known and the program is small. Imagine, though, how difficult a task it would be to keep track of execution in a normal Basic application.

Hescom transfers any amount of data in memory in both directions between two Pets or Vics, or a Pet and a Vic. It is especially useful for those owning both Pet and Vic, since any existing programs can be loaded into the Pet from disk and transferred to the Vic at three times the speed of the disk (a 3.5K program in half-a-second)—no more unnecessary waiting for Vic peripherals.

The Vic can be set up as a terminal or special peripheral to the Pet. This permits conversion of existing games into two-machine, two-player games. A program running on the Pet could display high-res color graphics on the Vic, produce four-voice sound, or even receive input from joysticks and paddles connected to the Vic.

Hescom is written entirely in machine code for speed and efficient memory usage. The two machines connected via user ports provide data transfer at about 7,000 bytes per second—three times faster than a 4040 disk. Hescom automatically adjusts itself to any memory size and is supplied with versions for the Vic and Pet ROMs 3 and 4, a demo program, custom 5-foot cable, and comprehensive user and program manuals.

Hescom operates much like Hescount: a Basic loader program is run that places it in upper memory. From this point, a program to be transferred would be loaded into the sending machine. Then the appropriate SYS command is typed. To send a complete program from a Pet to Vic, you would type "SYS 0,3" on the Pet and "SYS 0,0" on the Vic. The '3' is the command to send a program, and the '0' tells Hescom to receive the 'ile. "SYS 0" handles the overall initialization.

Transferring a range of memory follows the same format. The starting and ending addresses, along with the address for the program to be placed on the receiving machine are specified. For example, to send memory on the Pet from 1000 to 2000 and put it at 4000 on the Vic, one would type on the Pet: SYS 0, 2, 1000, 2000, 4000. On the Vic, type: SYS 0,0. The transfer occurs automatically and the program is relocated starting at address 4000.

Heslister is valuable in Basic programming, especially program modification. It untangles code, letting you follow program flow easily. The program operates on any Pet/CBM with at least 8K bytes of user memory and one disk drive. Operation is similar to Hescount and Hescom. To appreciate Heslister, consider this program:

```
0 PRINT "{CLR/HOME}{CRSR DOWN}{CRSR DOWN}
HESLISTER ROM3&4 8K DISK R1.2 3/17/81
 2 FORR = TTOU:T = LEN(T$(R)):S = T + 2:FORS = TTO
R9:F = F + S:IFS>10THENF = 0:F1 = 0:S = T – 2
 3 NEXT:IFT$(R)>CHR$(161)ANDT$(R)< = CHR$
(223)THENJ = 4 – S:ONJGOSUB6,8,10
 4 NEXT
```

Examine Heslister's impact on the same material (listing 2).

Besides indenting loops (missing NEXT statements can be easily spotted) and adding spaces for easy reading, cursor control characters are translated into printable format for an ASCII printer unable to accommodate Pet graphics. Output can be sent either to screen or printer. A header line is printed at the top of each page with the date, time and volume number of the disk containing the program. □

Program on page 154

Assignment: Benchmark

DYNABYTE 5300

Good Performance From an Integrated System

	C-3 Accounts Receivable Time (min.)	Current Price
Dynabyte 5300	4:38.0	$ 7,735
NEC Astra 205	5:10.8	$ 9,890
Altos ACS8000-15	10:41.5	$ 9,875
Wang 2200 SVP	2:23.0	$14,600
Pertec PCC 2000	6:04.3	$12,470
North Star Horizon	1:57.7	$ 6,911
Cromemco System Two	2:48.0	$ 9,275
Texas Instruments 771	3:38.1	$12,100
Vector Graphic System B	5:56.5	$ 8,995
DECstation 78	5:04.8*	$10,495
Radio Shack TRS-80 model II	3:38.6	$ 7,609
Apple II+	6:17.4	$ 4,330
Digital Microsystems DSC-2	3:28.8	$ 9,015
Ohio Scientific C3-A	15:49.3	$10,940
Alpha Micro AM-1011	3:25.3	$15,605
Data General CS/10 model C1	**	$13,400

Billings BC-12 DF2M
SD Systems SD-200
IBM Personal Computer
IBM 5120
Commodore CBM-8032
Smoke Signal Chieftan
Vector Graphic 3005
Xerox 820

to be covered in future issues

*Result includes both compile and run time.
**Time of 2:40.3 was obtained using hard disk system.

by Hillel Segal

The Dynabyte 5300 (Dynabyte, Milpitas, CA) is an integrated business computer system offered with accounting and word processing software. It was a strong performer in benchmark testing and has a number of desirable features.

Because it uses the same processor and compiled Basic language as the Altos ACS8000-15, many run times of the two systems were very close. The Dynabyte system offers somewhat greater expandability, however, and also differs in that the vendor supplies its own set of applications packages.

The 5300 is the second smallest in Dynabyte's 5000 series of business computers. All use the same Z80A processor and S-100 bus architecture. The 5300 has standard 8-in. drives. The less-expensive 5200 has dual

minifloppy drives. Larger systems in the line include Winchester hard disk storage, and some have removable cartridge tape drives as well.

The Dynabyte systems were tested for the Association of Computer Users (ACU) by the Business Research Division of the University of Colorado. The benchmark reports include the results of CPU and disk I/O-intensive tests, three real-life applications problems and a program editor comparison.

The full reports include an examination of the hardware and software aspects of the computers, plus a review of the documentation and results of telephone interviews with system users. Benchmark run times should not be used as the exclusive criteria for comparing different models of computers, but can be taken as one measure of performance within a greater context of software, accessories and vendor suitability.

Benchmark run times should not be used as exclusive criteria for comparing different models

Except as noted, all results shown here are run time only. Several systems have used compilers, and while the compile times are given in the full benchmark reports, they are omitted here. In practice, the end user would not be concerned with compile time since it is part of the program development process.

As tested, the model 5300 included the processor with 64,000 characters of memory (expandable to 400,000), two disk drives for a total of 1.6 million characters of storage, an intelligent CRT terminal, and an Epson MX-80 printer. Double-sided drives are also available.

The software used included the Dynabyte DOS operating system (an expanded, compatible version of CP/M) and compiled Basic. At the time the unit was tested, total price was $8,535. A price reduction has since knocked $400 off both the processor and disk drives, lowering the total package cost to $7,735.

These components were priced separately. Dynabyte does not specify a price for any printer model. Any standard dumb terminal can be used with the system. The Dynabyte terminal (model 5022) has a number of special function and programmable function keys, and displays underlined, blinking and reverse video characters.

The processor uses the S-100 bus with a total of 12 card slots. One parallel port and two serial ports are standard. Extra terminals can be added with special interface modules, each of which supports up to eight users.

All CP/M compatible languages are supported by the system, including Basic, Fortran, Cobol, Pascal and others. While the 5300 was tested using a CP/M-type single-user operating system, Dynabyte now offers MP/M and OASIS for multi-user operation. The Dynabyte DOS version 4 is a fully-implemented MP/M system with additional enhancements, supporting up to eight terminals and 16 printers. Each terminal can access any printer, with spooling of the printers so work at the terminal is not interrupted. CP/M programs can run under the multi-user DOS without modification. The maximum program size is 48K bytes.

The OASIS operating system supports up to 16 users in a time-shared, multi-tasking environment. It includes features such as direct, sequential, keyed and ISAM files, file locking, passwords and dynamic user accounting. Extra languages supported under this operating system include Forth and C.

Dynabyte supplies three types of software for its systems: business accounting, financial planning, and word processing. The accounting system contains six standard application modules and one optional. Standard modules are sales order entry, accounts receivable and payable, inventory control, purchase order management and general ledger. Payroll is optional.

Designed for the enhanced MP/M operating system, the accounting package, Business Manager, can be used in a single- or multi-user environment. It is completely menu-driven, including all backup utilties and file security. An on-line help function is provided to give extra information on the various functions.

The integrated nature of the packages allows posting of only one set of entries per transaction, with subsequent entries in other modules handled automatically by the system. Customization features allow users to modify aspects of the programs, such as aging periods for reports, customer credit terms and finance charges. The software comes with a training diskette—including sample data and step-by-step instructions for using each application.

Business Planner, the financial planning package, provides an electronic spreadsheet much like that of the popular Visicalc program. It allows the user to set up and label rows and columns (up to 50 rows by 20 columns, expandable with use of another software module), then designate calculations to be performed. If the input variables are altered, the calculations are automatically performed again by the system.

Typical uses of the planning package include financial report preparation, capital budgeting, sales forecasts, cashflow planning and other types of economic analysis. Like the accounting system, the planning package may be used in either single- or multi-user environments.

The word processing software offered by Dynabyte is the Wordstar package, designed by Micropro. It includes the basic editing and formatting functions, plus column moves, special printing modes such as boldface and subscripts, etc. Optional modules are available for creation of personalized form letters and spelling verification. Two self-training courses are offered.

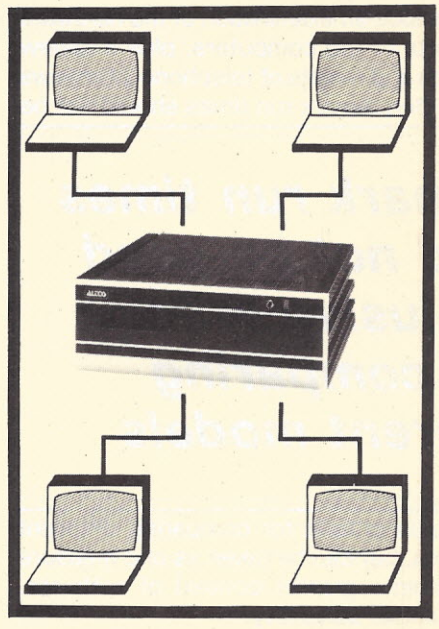
Of the users surveyed, several noted hardware problems during the installation of the system. Once solved, however, the system worked reliably. Maintenance is provided by the local dealer, and a service contract is offered; most users said they'd received good service when necessary.

The 5300 appears to be a system worthy of definite consideration.□

Research Associate: Vic Schoenberg

Hillel Segal is president of the Association of Computer Users, a non-profit association with members all over the U.S., Canada and several foreign countries. A complete package of information about membership is available from ACU, Box 9003, Boulder, CO 80301.

ALTOS ACS8000-10



by Tom Fox

Computers from Altos (San Jose, CA) have always been substantial, weighty units— the ACS8000-10 is no exception. It's a solid 80 pounds, almost too heavy for one person to handle. It measures 19-in. wide by 22-in. deep by 7-in. high—about the size of the CPU of a medium-size minicomputer.

Though designed for rack mounting, the wood-grained side and top panels render it aesthetically acceptable as a table-top unit. Altos systems are often installed in the pedestal of an integrated desk-style piece of furniture. In that environment, all that can be seen of the ACS8000-10 is the crisp black-and-white facade of the front panel with its single floppy disk opening.

The rectangular shape of this machine encloses all of the computer's electronic components as well as two disk drives—one soft, one hard. The only external components needed are a display terminal and printer. These are devices that Altos does not manufacture. The box is solidly packed, with disk drives in front and no fewer than 10 multi-pin input/output connectors arrayed across the rear. The interior is dominated by a sandwich of large circuit boards, the largest measuring 15½-in. by 16½-in.

Altos is a firm believer in the single-board computer concept. This is the philosophical opposite of the bus approach to processor design. The latter involves a series of circuit boards, which plug into a row of connectors on a common mother board. Bus philosophy adherents claim their systems are easier to repair, and simpler to expand as the user's needs grow.

Altos, however, contends that the hundreds of extra connection points necessary in a bus system can themselves become the cause of maintenance headaches—in addition to adding unnecessarily to manufacturing cost.

Contained on a single board of the system, then, are CPU, 208K bytes of RAM, a double-density floppy diskette controller and seven I/O ports. A second circuit board about half the size of the main one contains the controller for the Winchester-technology hard disk drive. Tucked in among all this is a compact conventional linear type power supply.

The main single-board computer is a multi-talented device. Equipped with an 8-bit Z80A microprocessor running at 4 MHz, this board is capable of running four separate sets of operating system software. The familiar single-user CP/M and companion multi-user MP/M operating systems are supported. In addition, both the single- and multi-user varieties of OASIS can be accommodated. CP/M and MP/M are products of Digital Research (Pacific Grove, CA), OASIS comes from Phase One Systems (Oakland, CA). Sprinkled about the computer board is a host of configuration block matrices. These must be set properly by your dealer to conform to the disparate needs of the various operating system choices.

As a microcomputer, the ACS8000-10 competes in many areas with the smaller end of the range of minicomputers. One of these areas is multi-user processing, handled by MP/M or multi-user OASIS operating system software programs. These programs cause the single Z80A CPU to distribute attention across the needs of several users over short periods of time. Since these time periods may be as short as milliseconds, each user can operate under the illusion that he or she occupies the full attention of the computer.

Multi-tasking, as this is called, is one of the two current methods for providing these capabilities in a micro-

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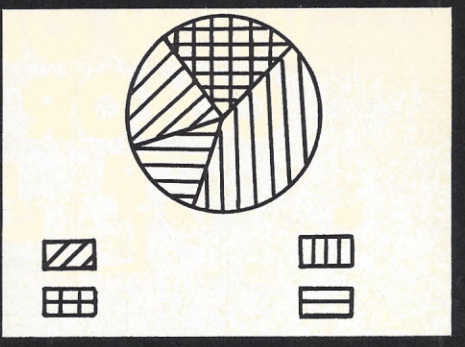

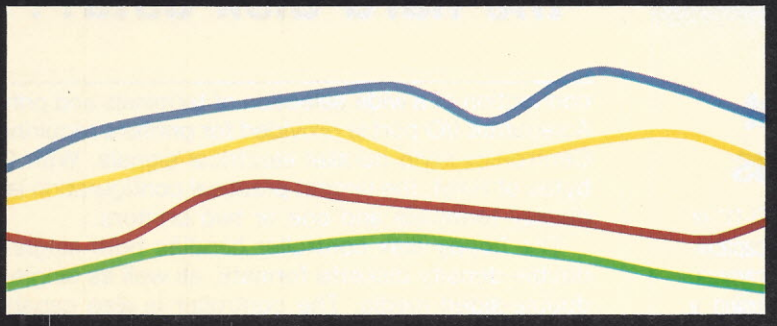

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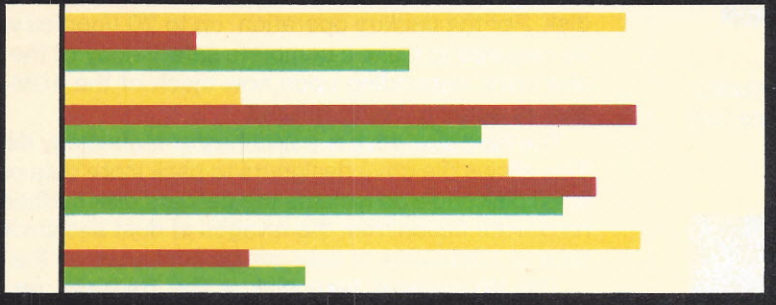

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GrafTalk requires a computer using a CP/M*-80 compatible operating system as well as a video terminal and one of the wide variety of printers*, plotters**, or graphics CRTs.

The following is a partial list of supported printers and plotters.

***Printers**
Diablo 1640, 1650, 630†
NEC Spinwriter†
The following must be used in conjunction with a graphics terminal, such as Autograph 110, etc.:
Epson with GrafTrax†
Anadex with 'R' options

****Plotters**
HP 7220/1/5
Houston DMP3/4/6/7
Tektronix 4662
Watanabe WX4630/75

The illustrations are artist's representations of graphs produced by GrafTalk, and not actual reproductions.
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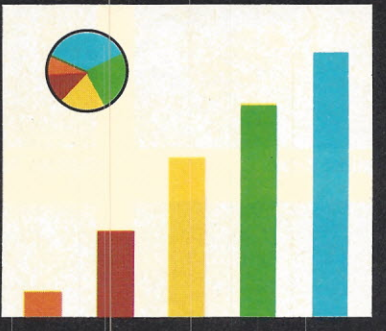

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CIRCLE INQUIRY NO. 61

computer. The other involves individual user CPUs and coordinating inter-processor communications and the shared use of common peripherals with specialized software. Termed multi-processing, this requires additional hardware expense, but yields greater performance for certain tasks.

Except for terminals and printers, the ACS8000-10 is equipped for multi-user operation. Six separate serial I/O ports conform to the EIA RS-232 standard, allowing

. . . up to 20 floppies would be required to make a complete safety copy of the hard disk data. . .

connection of a wide selection of terminals and printers. A separate I/O port is provided for printers requiring the Centronics-style parallel electrical signals. With 208K bytes of RAM, the largest practical configuration is four display terminals and one or two printers.

The floppy disk controller handles both single- and double-density diskette formats, as well as single- and double-sided media. The controller is also capable of handling up to four separate diskette drives. Only one is included with the standard ACS8000-10; it is a single sided, double density unit holding up to 500K bytes of data per diskette. The floppy diskette drive is included for two purposes: transporting programs and data between your computer and others with compatible diskettes, and making backup copies of the information on the hard disk. For the backup operation, up to 20 floppies would be required to make a complete safety copy of the hard disk data, depending upon how much of the 10M-byte disk is actually being utilized.

The hard disk drive is a Winchester technology device. This allows the drive designers to pack more data onto a small disk and also isolates the delicate disk surface and read/write heads from the ravages of dust and smoke. A total of 10M bytes of data can be contained on the disk.

The Winchester hard disk is the SA1000, an 8-in. device supplied by Shugart. In CP/M parlance, it is configured as a single "E:" drive containing the entire 10M bytes of data. The floppy diskettes are pre-allocated the addresses "A." through "D.". A second Winchester, when added, carries the "F." designation. In addition to holding a great deal more information, the hard disk drive is faster than the typical floppy. It is also more reliable. If your experience is limited to systems running just floppy diskettes, you should spend some time with a Winchester unit. It can transform a micro into a serious business-minded machine.

Testing the Altos provided the opportunity to compare three examples of the Basic language version from Microsoft (Bellvue, WA). From Apple to Radio Shack, from IBM to almost any S-100 bus computer, the various incarnations of Microsoft Basic make it the closest thing to a standard language we have in the industry. Now designated Basic-80, Osborne calls it MBasic; others have it privately labeled.

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MAXIMUM MEMORY	256 K	256 K	544 K
SOFTWARE SELECTIONS	VisiCalc® Data Communications Word Processing CP/M® 86	VisiCalc® III Data Communications Word Processing Data Base Mgt. Business Graphics CP/M® Library Apple II Library	VisiCalc® PLUS Data Communications Word Processing Data Base Mgt. Graphics Presentations Statistics (3 pkgs.) Financial Decisions Linear Programming Math AC Circuit Analysis Waveform Analysis CP/M® Library Series 80 Users' Library
EASE OF USE			
Programmable Soft Keys	10	0	14
Error Messages	73	38	107
Built-in Disc Operating System	No	No	Yes
Built-in Screen Graphics	No	Yes	Yes
RELIABILITY			
Self Diagnostics	Yes	No	Yes
Operating Temperature	61-90°F	No figures available	32-133°F

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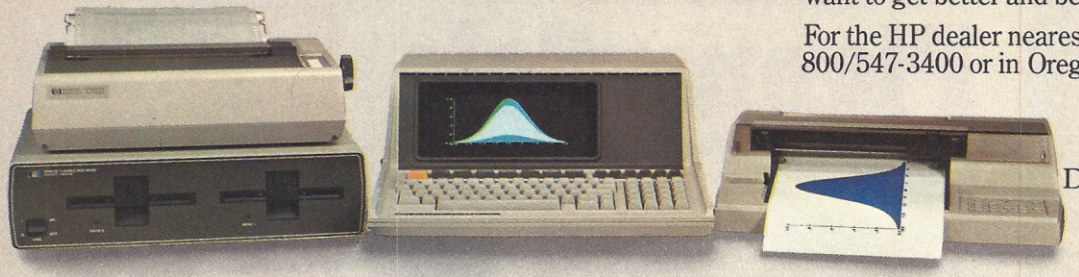

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CIRCLE INQUIRY NO. 45

Basic-80 is currently into Release 5 (5.2.1 on the computer we tested), and differs in significant areas from pre-4.5.1 versions. For one thing, it's bigger, taking up 6,593 additional bytes of RAM. On the plus side, variable names can be a full 40 characters long, encouraging a degree of self-documentation within programs. A dozen or so of the internal functions have been cleaned up. Some of the operations are different enough so that applications programs written in earlier versions might need minor conversion before they can run on Release 5. Software developers will like the fact that programs written in the new package can be distributed in an unlistable protected binary format.

The new Basic also runs faster. Using our Prime Number Cruncher benchmark program (*IA* Aug 81), we observed the new language to be 8.2% quicker at 693 seconds. Our test system was running under CP/M Release 2.24.

For real speed, there's BASCOM. This is Microsoft's Basic Compiler, a product that transforms a Basic-80 program into directly CPU-executable machine code. An application compiled in this manner operates differently than most Basic programs, which must undergo a line-by-line interpretation of each program statement as they execute. The modest extra effort of invoking BASCOM provides spectacular results. Our Prime Number Cruncher finished in just 235 seconds. That's over triple the speed of the interpreted version of the same program.

The bottom line

Altos' documentation is more complete than most—although not packaged as attractively at that of the competition. *The Computer System Users' Manual* is a slim, densely-packed document, evidently written with the knowledgeable technician and/or programmer in mind. Even so, the well-illustrated setup procedures are clear enough for a novice to follow. Each computer is supplied with a complete booklet of schematic diagrams, along with a brief description of circuit operation. More documentation comes with the software packages.

The ACS8000-10 computer system, less software, lists for $8,500. (Remember that the hardware must be completed by the local addition of terminals and printers.) CP/M sells for $150, MP/M II for $500. OASIS is available for $500 in the single-user configuration, or $850 if multiple terminals are desired. The Basic-80 interpreter is $350; add another $395 if the compiler is added. Many other languages are offered, from CBasic at $150 to CIS Cobol at $850.

The list goes on to include applications software such as Wordstar word processor, Microplan financial analyzer and a database management system by Phase One. Telecommunications software is also offered.

The ACS8000-10 is but one example of an unusually wide range of Altos business micros. Beginning with a $3,650 single-user floppy-only computer and extending to a 40M-byte four-user machine listing for $15,500, the ACS8000 family is software compatible throughout. One of the most popular options is the 17M-byte cartridge tape backup unit. This subsystem sells for $3,500, and resolves the multi-diskette floppy backup dilemma.

For the future, Altos is banking on the 16-bit 8086 microprocessor device for the recently-developed ACS8600 series. There's one that contains the same disk complement as the one we tested that can be purchased for a premium of $4,490.□

Articles Wanted . . .

INTERFACE AGE is seeking articles relating to future computer developments for the December issue. Projections for 1983, as well as previews of what the next five years will bring will be considered. Both advancements in specific products and improvements in technological trends will be topics of interest. Articles intended for this issue should be received no later than August 1 for consideration.

Other topics being solicited in coming months include: legal, medical and educational applications, word processing, portable and pocket computers, peripherals and interfacing products, computer art and graphics, tutorials, advice for first-time users and utility programs. *Special emphasis is placed on business systems, software and applications.*

Program listings should be no more than 60 characters wide, with no wrap-around lines. Unlined paper and a new ribbon should be used. Sample runs should be included. In the article text, variables should be described. The system utilized in composing the program should be detailed—operating systems, langauge type and version, and any necessary peripherals.

Manuscripts should be typed or printed out double-spaced with one-inch margins. Minimum text length is eight pages, whether or not the article is accompanied by a program listing.

Photos should be numbered and have a brief description attached to each. Tables, figures, etc. should be on separate pages, and each should have a caption.

Submittals should be prefaced by a brief description of the article. Authors are requested to include a statement of background and expertise.

The publisher assumes no responsibility for artwork, photos or manuscripts. No acknowledgement is made unless the submittal is accompanied by a large, stamped return envelope. A minimum of six weeks should be allowed for a response; please do not phone for information about submittals.

The submittals should be addressed to: Editorial Dept., Interface Age, 16704 Marquardt Ave., Cerritos, CA 90701.

One final note: Articles intended for a particular month should be in our office no later than four months prior to the cover date.

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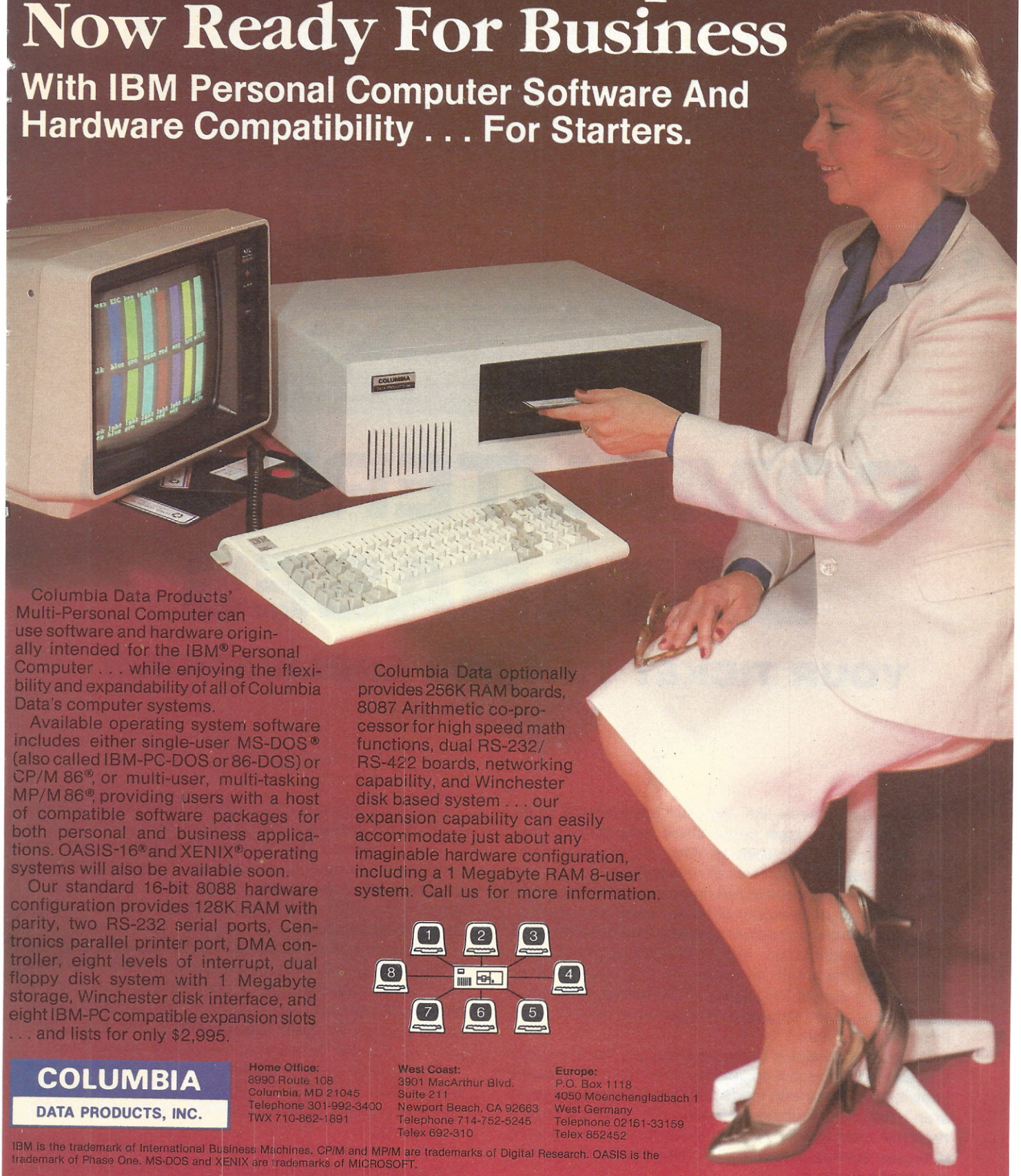

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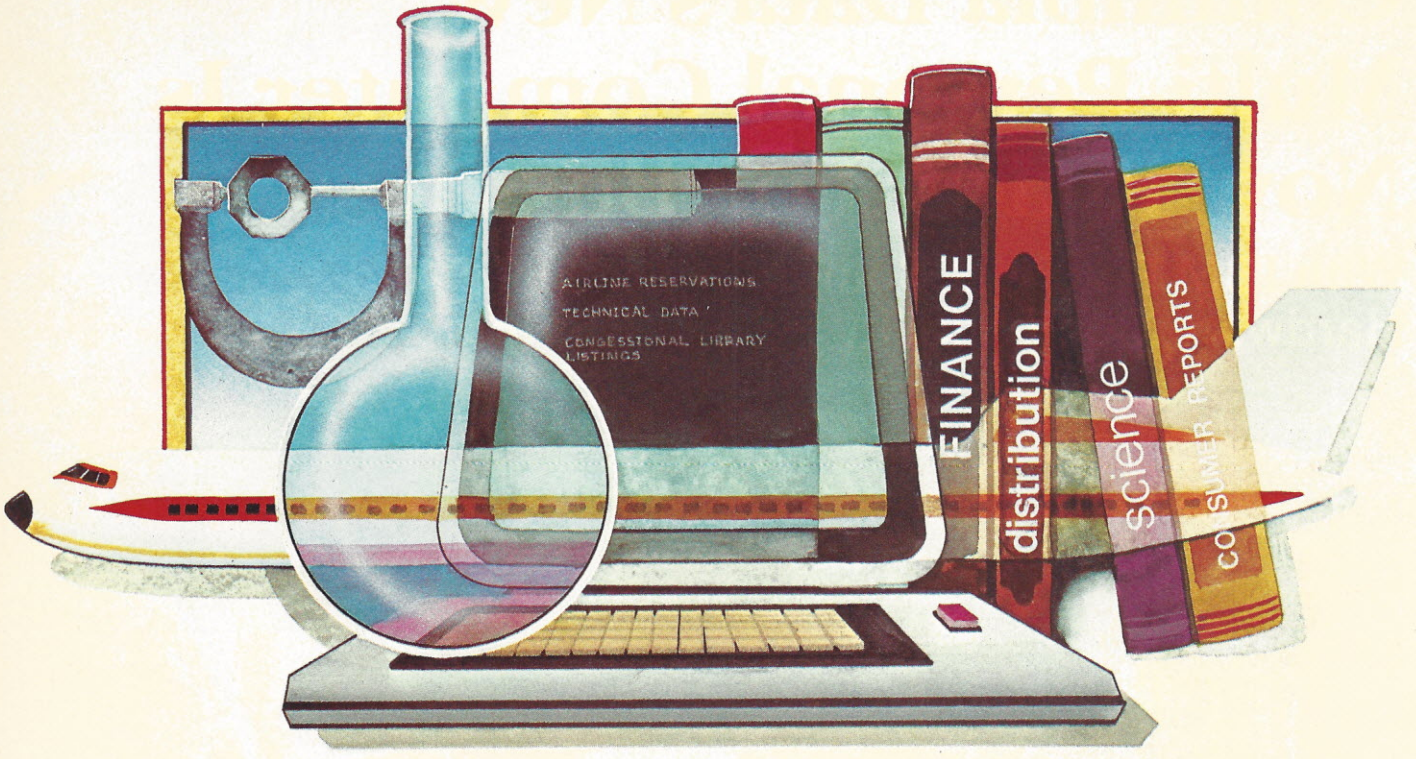

COMPUTERIZED DATABASES

YOUR TICKET TO 1,001 APPLICATIONS

by David D. Busch

Online databases—like trips to Mars—have been written and fantasized about since long before they became practical possibilities. After all, why duplicate extensive research libraries in universities all over the country? A single, centralized computer database could provide users nationwide with the same information, using data processing power to streamline searches and statistical manipulation. Yet, it is still not possible to access one mammoth all-encompassing encyclopedic computer, a sort of DP Library of Congress. Instead, a host of specialized database services have risen to meet information needs.

Costs of maintaining these services are more logically spread among those who actually need the accumulated knowledge. Those with modest information requirements aren't forced to subsidize those with more extensive database maintenance requirements. Individualizing each database service allows tailoring information retrieval to the group using it.

Even so, there are some general purpose databases aimed at the general public and business user. Compuserve Information Service and The Source are the best-known examples. In addition to data processing and hobbyist applications, both offer access to a number of useful databases through simple menu-oriented commands.

Compuserve allows tapping into the newsfiles of some of the leading U.S. daily newspapers, such as the New York *Times*, Washington *Post*, Los Angeles *Times* and the Minneapolis *Star*. Airline schedules, Dun and Bradstreet stock quotations, gold futures prices and magazines such as *Popular Science* are available online.

The Source also provides entree to stock market information, including the UNISTOX database of 160 financial reports, airline schedules, news and a variety of other data.

The proliferation of online databases—both specialized and general—has come about for a number of reasons.

As microcomputers have replaced minis for many applications and made new inroads in others, the base of potential users has expanded. Desktop computers are found in offices throughout the United States and low-cost terminals inhabit others. The terminals might have been installed to allow access to a time-sharing computer or specifically for accessing a research database.

These terminals are able to communicate much faster —at 300 baud instead of 110, or (in many cases) at a very practical 1,200 baud—so downloading the information is less time consuming. Growing telecommunication networks, like Tymnet, allow many more users to access international databases through a local phone call. This is an important factor—what researcher in Cleveland could afford to access a database in Washington, D.C. if the phone call alone costs more than $50 per hour in prime time?

Hardware and software advances have made online databases more practical to build and maintain. The per-character data storage costs have dropped dramatically while rapid-access storage devices have increased in capacity and reliability. Mainframes have become more powerful, making it simpler for a large number of users to work interactively with a CPU at the same time.

Special programs with user-oriented query features allow efficient searches even by untrained customers, reducing both user and CPU time.

There are two essential kinds of online databases. The "source" database is the kind of information repository that made up so many science fiction writer's dreams. Such information centers contain all of the data or the complete text of the original source, Newswires, containing a full story, or an online dictionary with complete definitions are typical examples. Source databases may contain either text or numeric data, or a combination of the two.

A second type of information resource is the reference database. The main function is to refer the user toward an original source for the information. These may include source databases, journal articles, patents, organizations, individuals or audiovisual materials. This type of database may be thought of as an index to information that is not limited to one medium or type of data provider.

Both types of information must be compiled by someone—the producer of the database. The producer may or may not also be the group that makes the data available through an online service. Many provide their own service, while others make the database available to another information provider that offers online services to users.

Some producers are dedicated to furthering the field. These groups seek to improve the quality of data available to others in a specific industry or line of study. Such databases may be available to users at cost

A Sampling of Online Databases

Name	Subject	Type	Producer	Content
Agriculture	Agriculture	Source	Data Resources	Historical commodity supply, demand, price information.
Arbitron Radio Arbitron TV	Broadcast Marketing	Source	The Arbitron Co.	Ratings of broadcast stations, audience measurement.
Auto-Cite	Legal	Reference	Lawyer's Cooperative Publishing Co.	State and federal caselaw, to check citations or research.
Billboard Information Week	Music	Source	Billboard	Playlists from 400 participating stations.
Books In Print	Publishing	Reference	R.R. Bowker Co.	Citations to 640,000 current and 60,000 upcoming books.
Commodities/Futures	Investment	Source	Call Computer, Inc.	Daily updates on price of commodity futures contracts.
Common Stock	Investment	Source	Securities Data Co.	Essential data on 5,000 command and pref. stock issues 1970-present.
Information Bank	News	Reference	New York Times Information Services	Abstracts on news items from New York Times, and 10 other newspapers.
Magazine Index	General	Reference	Information Access Corp.	Citations to articles in 370 U.S. and Canadian magazines.
NASA	Science	Reference	NASA	Citations and abstracts on space and aeronautic science and technology.
Newsbeat	Economics	Source	GTE Information Systems	News items on securities, etc. from Dow Jones News Retrieval Service.
OAG	Aviation	Source	Official Airline Guides	Scheduled activity of 600 airlines worldwide.
Telequote III	Investment	Source	Bunker Ramo Information Systems	Realtime stocks, bonds, information, etc.
Zip Code Demographic Data Base	Social Sciences	Source	Demographic Research	Demographic data on 35,000 U.S. zip codes

. . . the information becomes available to users by contracting individually with each service. Many require an annual subscription fee. This can range from a few hundred dollars to several thousand.

or for a small profit, which is plowed back into the organization. Other databases are put together by government agencies with a responsibility to the public to make such information available.

Other producers assemble databases solely with a profit motive. Their business may consist entirely of providing consulting or advisory services to business, industry, or education. The databases might be assembled from scratch or obtained from government sources that originally compiled them. In the latter case, maintaining and updating the information is the responsibility of the firm marketing the data.

In both instances, the information becomes available to users by contracting individually with each service. Many require an annual subscription fee. This can range from a few hundred dollars to several thousand. Database access may also be included as part of a total timesharing package, or charged according to usage. A combination of these pricing techniques can also be applied.

Timesharing services (see "Timesharing vs. Buying" *IA* Mar 82) offering databases will usually charge for connect time, CPU time, and (if necessary) disk storage of information retrieved. In addition, a surcharge may be added to compensate the service for the "extra" costs incurred in maintaining the database or in paying the producer.

Other database services bill according to hourly connect-time rate. Use of telecommunications networks, such as Tymnet are extra. For example, Compuserve currently charges $5.00 per hour during non-prime time (after 6 p.m. weekdays, and all day weekends and holidays), with a $2.00 per hour surcharge for Tymnet. Specialized databases charge proportionately more—reflecting access by a more limited group of users. These charges can run from $20 to more than $300 per hour. Compuserve and other services have an additional charge for offline printing. This is valuable to those without a hardcopy terminal or printer, and who don't have enough printing requirements to justify an investment in either.

How does one locate databases to access? If your chosen field does not have a national organization or clearing house for such information, a good place to start is an index to computer services such as *Directory of Online Databases* (Cuadra Associates, Santa Monica, CA).

Another source is the *Encyclopedia of Information Systems and Services* (Gale Research, Detroit, MI). This volume not only lists online services, but also organizations that will research selected topics for agreed-upon fees.

According to the Cuadra guide, the largest database category is business and industry. Dozens of databases are available, serving agriculture to banking, insurance to real estate to securities and urban planning.

Under the multidisciplinary category, Cuadra lists biography, consumer affairs, government databases and news. Science and technology databases encompass aeronautics and engineering, as well as life sciences and nuclear engineering. Another major category—social sciences and humanities—offers a host of databases dealing with art, education, history, music, psychology and other studies.

The accompanying chart shows a few of the typical services being offered. It would not be possible to present a complete list here—even for a limited field such as securities, stocks and bonds. But the list should provide an introduction to the thousands of information items available.□

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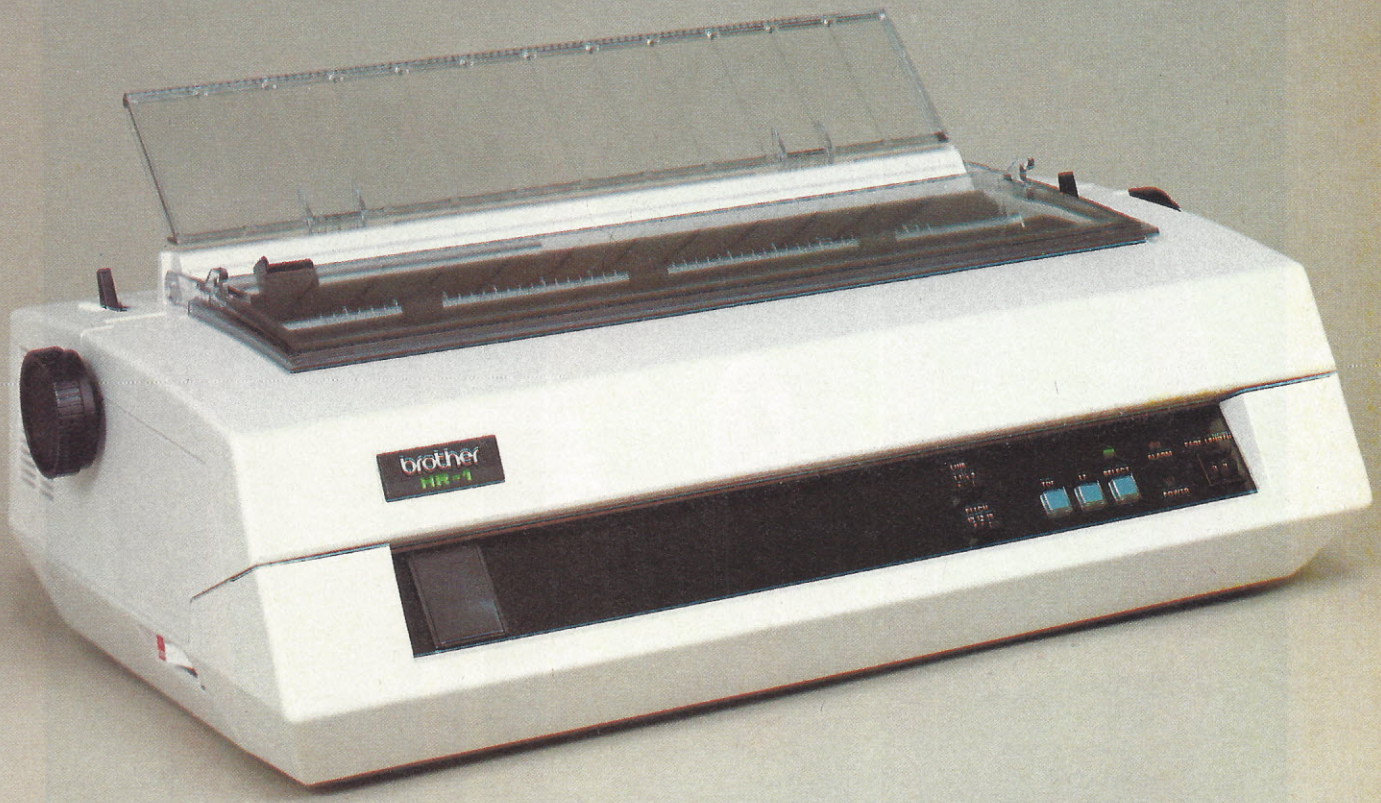

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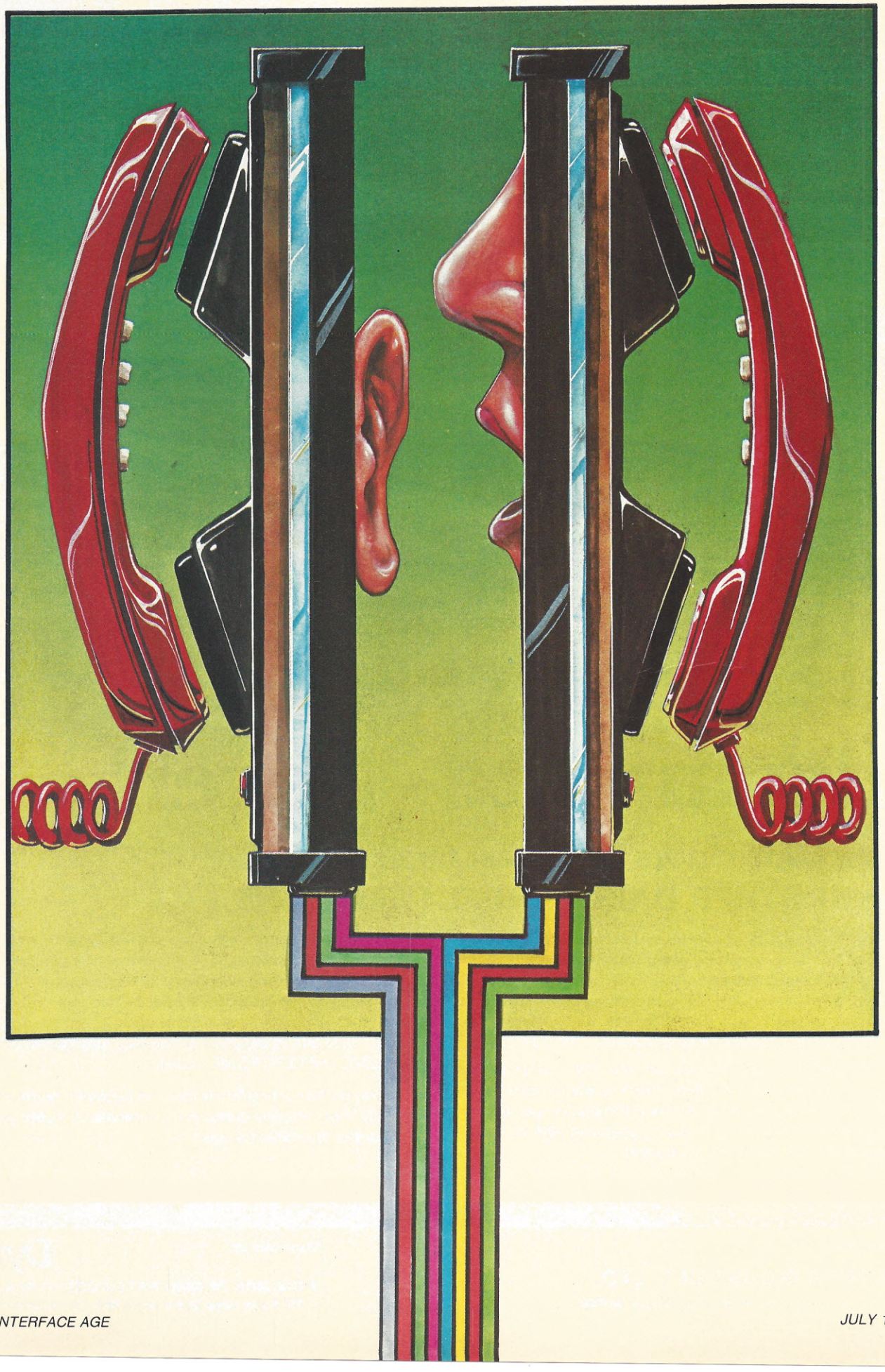


COMPUTER COMMUNICATIONS USING THE TELEPHONE NETWORK

by Robert Owen and Eugene Doroniuk

There has been an enormous growth in the use of the telephone network for computer communications—remote computing is now so widespread that few people are not directly affected by it. Let's take a look at the type of signals the telephone network carries, the necessary modems and the types of lines available to the user.

A communications channel can be described in terms of the frequencies it can carry. The Public Telephone Network—intended for voice transmission—has been designed to transmit signals between 300 Hz and 3,400 Hz. Although the human ear can detect frequencies up to 20,000 Hz, research has shown that if the upper and lower frequencies are cut out, so that only frequencies within the range 300 Hz to 3,400 Hz are transmitted, the listener can adequately understand and recognize the speaker. This is called a voice grade line. The characteristics of the network vary over the 300 to 3,400 band, misshaping any signal composed of more than one frequency. There are two types of distortion involved: attenuation distortion and delay distortion.

Attenuation distortion describes the decrease in amplitude of the signal as it travels from one point to another. The signal is distorted because different frequency signals are attenuated from different amounts. Delay distortion occurs when there is a difference in the time of arrival between two signals, at different frequencies, which were transmitted at the same instant. This could be a problem if the two signals are to be synchronized.

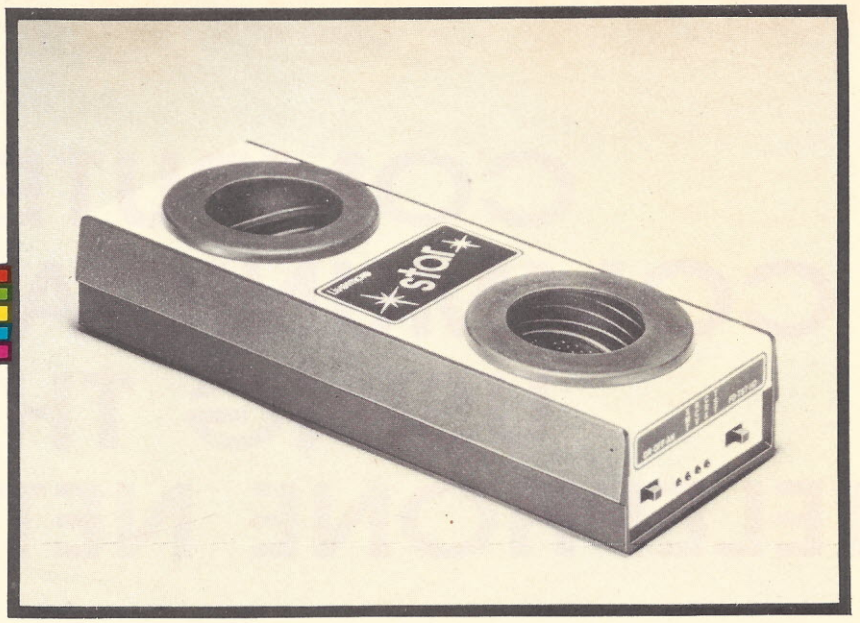
To reduce attenuation distortion, telephone companies place repeaters about every 6,000 feet along the telephone line. These amplify the telephone signal in such a way as to compensate for the unequal reduction in signal strength along the line. Delay distortion is compensated by the use of equalizers to give an approximately equal delay for all frequencies transmitted over the range 300 Hz to 3,400 Hz. This process of adding repeaters and equalizers is called conditioning, and results in the telephone line having a characteristic curve as shown in figure 1.

Digital data transmitted or received by a computer is in binary form and consists of rectangular pulses, as shown in figure 2a. Since a square-edged waveform contains extremely high components of frequency, only frequency components between 300 Hz and 3,400 Hz would be transmitted if this signal were sent along a voice grade telephone line, distorting the signal to the shape shown in figure 2b. This could make the message unintelligible to the receiver. If a series of 1s were to be transmitted (essentially a DC signal), no message would arrive at the receiver because the line has an infinite impedance to a DC signal (see figure 1).

If distortion is to be prevented, the rectangular pulses from the computer must be represented as audio signals in the 300 Hz to 3,400 Hz range. To perform this, a device called a modem (modulator/demodulator) is placed between the computer and the telephone line, while a second modem is located at the other end between the telephone line and the terminal, as shown in figure 3.

The modem converts the serial, square wave data from the computer into an audio frequency signal suitable for transmission along the telephone line. When the signal reaches its destination, a second modem converts the audio signals back into square wave pulses for processing by the terminal.

Every modem has two sets of circuits: a modulator, or square wave to audio section for transmitting data through the network; and a demodulator, or audio to square wave section, for receiving data from the



telephone network. These two sets of circuits are generally independent of each other and can both operate at the same time if necessary. Although we have only considered messages sent from a computer to a remote terminal, exactly the same process is involved when the terminal transmits data to the computer.

In order to pass messages from the modem to the telephone network for transmission, sophisticated computer installations have a direct electrical connection between modem and telephone line. If a computer only transmits data infrequently through the telephone network, a type of modem called an acoustic coupler is often used to connect the computer to the telephone line.

The accompanying photo shows a typical acoustic coupler in which the telephone handset fits into a plastic cradle. The handset mouthpiece sits next to a small loudspeaker while the handset earpiece sits next to a microphone. This configuration—inexpensive and simple to operate—allows messages to be passed easily between the telephone network and the computer or terminal, as shown in figure 4.

There are three methods by which a modem can convert square wave data into an audio frequency signal: amplitude modulation, frequency modulation or phase modulation. Consider transmission of the digital signal 0010110010. With amplitude modulation, every time a binary 1 is transmitted, an audio signal is sent down the line, as shown in figure 5a. The receiver only has to detect the presence or absence of an audio signal to determine if a 1 or a 0 has been transmitted.

Modems that use frequency modulation send one of two frequencies, f_1 or f_2, down the line at a time. When a binary 1 is to be sent, f_1 is transmitted, while f_2 is transmitted when a binary 0 is to be sent. (See figure 5b.) The receiver detecting either frequency on the line can thus determine if a 1 or a 0 has been transmitted. Frequency modulation is more expensive than amplitude modulation, but the error rate caused by noise on the line is reduced. This compensates for the extra cost. Data can be transmitted faster with no reduction in the quality of the message.

The third technique is phase modulation. Consider a constant frequency signal being transmitted down a line. If the phase of the signal were to change by 180°, this could be used by the transmitter to send information to the receiver. (See figure 6.)

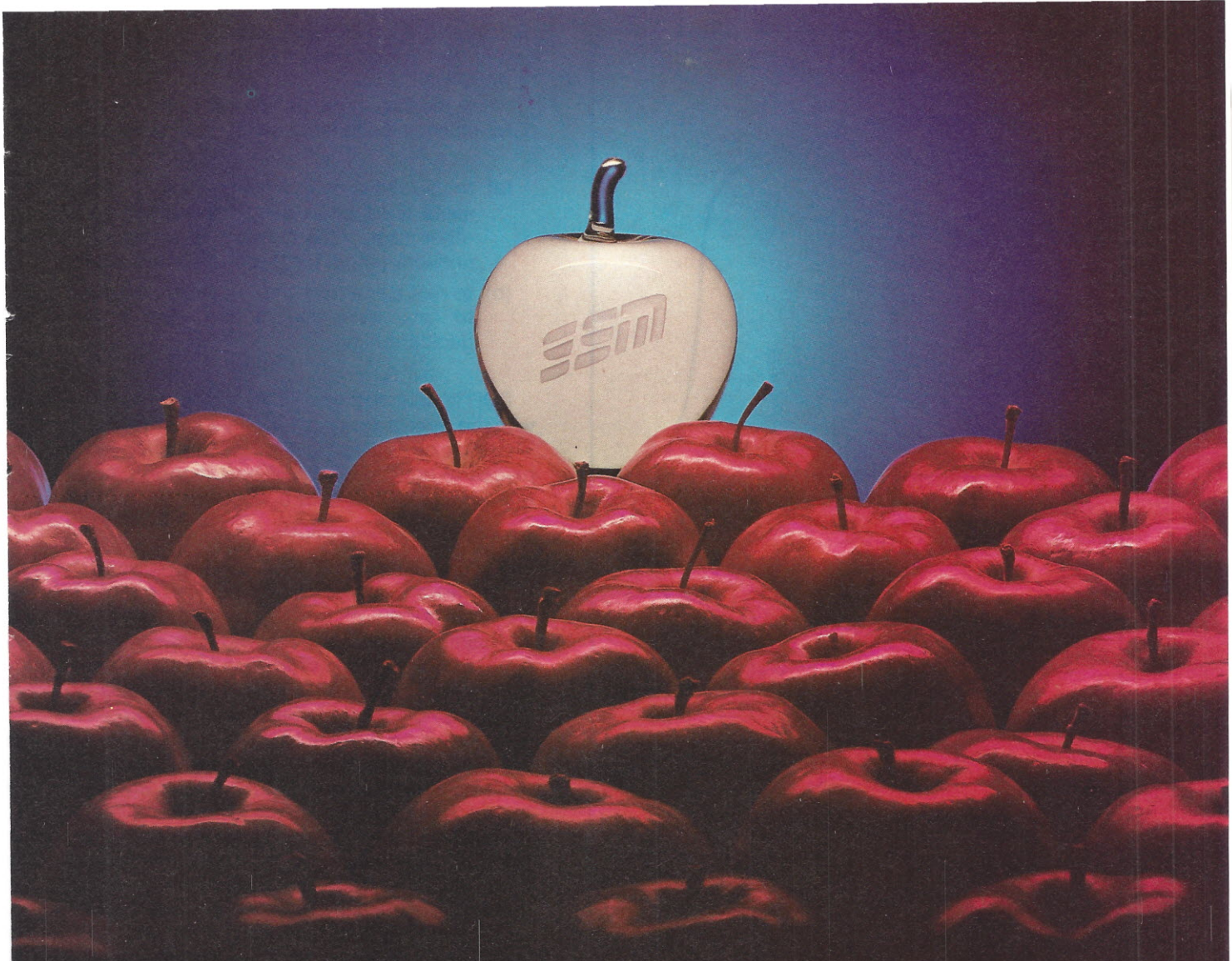
There are two methods of phase modulation. One phase is used to transmit a binary 0, while a 180° phase difference is used to transmit a binary 1. If one phase is continuously being received, the receiver interprets this as either a series of 0s or a series of 1s. If one phase is the phase received. With the second method of phase modulation, a phase change occurs whenever a binary 1 is sent. If a series of eight 1s were sent, then there would be eight successive phase changes in the signal. Unlike the first method during which there would be two phase changes, the first at the start of the series of 1s, the second at the end of the eighth 1. (See figure 5c.)

Phase modulation has the highest immunity to noise of all the modulation techniques and is widely used. A disadvantage is the electronic circuitry required to implement it. The complexity makes it more expensive than the other two methods.

The communication channel between a computer and a remote terminal can be designed to transmit data in different ways. The two methods used are half duplex and full duplex. Which of the two methods is selected depends on the computer configuration used. The telephone system will support either half or full duplex working.

With half duplex working, information can be transmitted over the telephone system in either direction—but only in one direction at a time. When the computer finishes sending data to the remote terminal, the terminal can send data back to the computer. The remote terminal has to wait until the computer stops transmitting data before it can send information of its own.

When full duplex working is used, data may be sent through the telephone network in both directions simultaneously. That is, data can be sent to a remote terminal at the same time as the remote terminal is sending data to the computer. With the DDD system, the modulation frequencies used by the computer's modem for transmitting data must be different from the frequencies used by the remote terminal's modem. Otherwise the two streams of data may interfere with each other and become garbled. Obviously, with full duplex operation, the receiving equipment at the remote terminal must be able to detect the transmission frequencies of the



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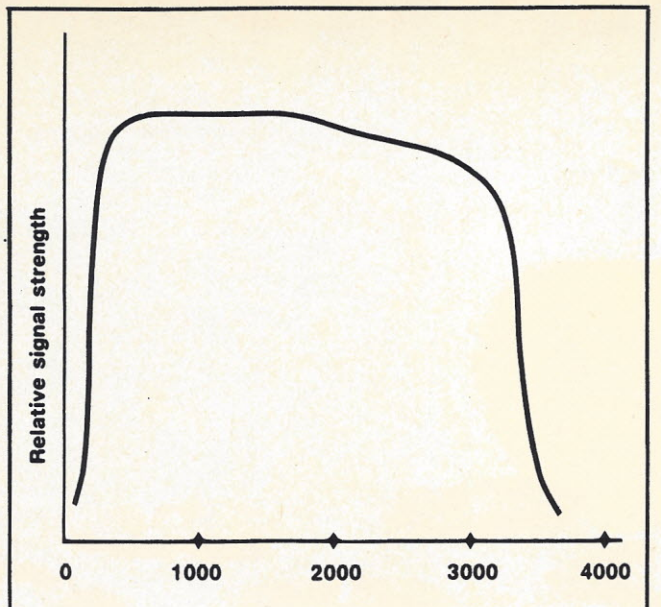

Figure 1. Characteristic curve due to conditioning

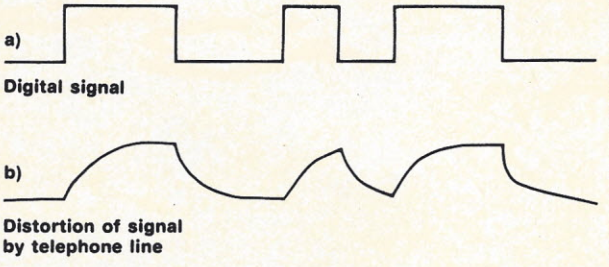

Figure 2. Digital signal and its distortion

computer's modem. The computer's modem must detect the transmission frequencies of the remote terminal's modem.

When the telephone network is to be used for computer communications, there are two options available:

(a) to use the dial-up network. That is, to use the same lines and dialing procedures as every other user. This network is called the DDD network (short for Direct Distance Dialing).

(b) to rent a line from the telephone company and to have its exclusive use. This is called a dedicated line.

DDD is selected when the computer communicates with the remote terminal for only a small part of the day. The cost of dedicating a single line between the two pieces of equipment would be expensive, considering the amount of time that it would be used.

Automatic communication

The second method would be chosen when the computer needs to communicate with the remote termina for a large part of the day. A bank branch passing information on deposits and withdrawals to the centra computer at the head office would employ a dedicated line. It would be selected because the cost of dialing the same number many times each day would be more expensive than the cost of the dedicated line. Also, with the dial-up network, the time delay waiting for the ca to be connected is comparatively long, interfering with the smooth operation of the computer system.

Using the DDD network, modems exist that automatically dial the desired number without computer operato intervention. Similarly, the equipment dialed could autc matically answer the call and process the originatin equipment's data, or request for data, without operatc intervention. The call could be automatically terminate at the end of transmission. This option is not availabl to computer systems using acoustic couplers. In thi case, before data transmission could start, the compute operator would need to dial the number, then place th telephone handset into the modem's cradle. If th number being dialed also used an acoustic coupler, th

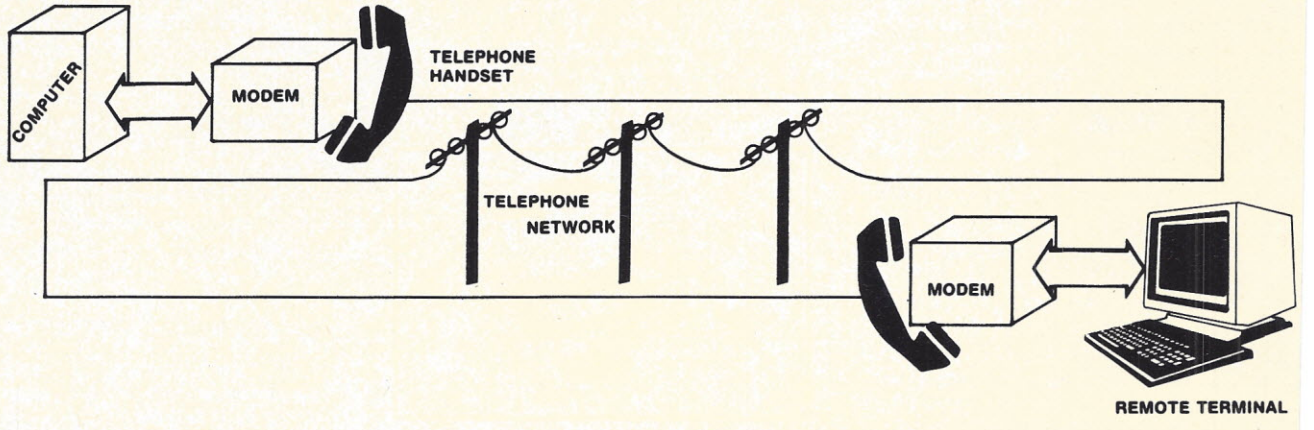

Figure 3. Modem for interfacing

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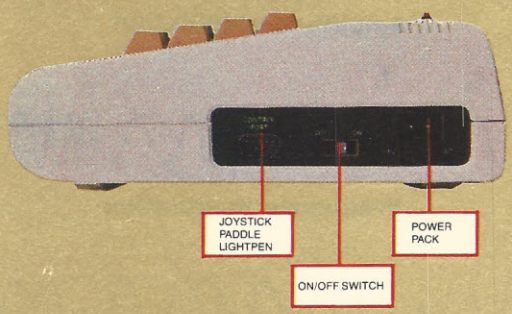

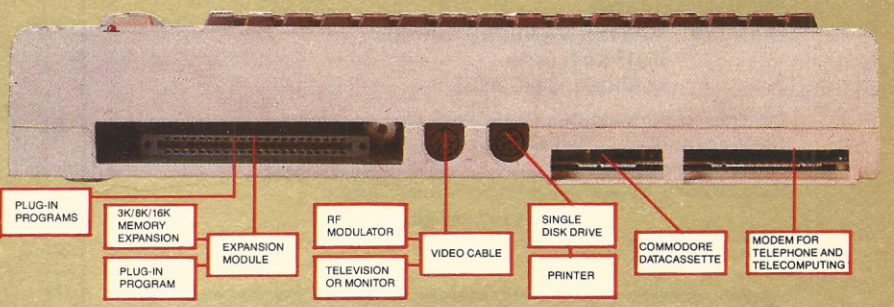

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Product Features	Commodore VIC-20	Atari® 400™	TI® 99/4A	TRS-80® Color Computer
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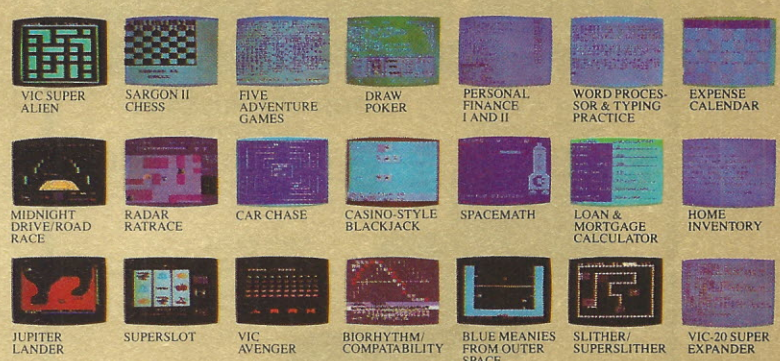
Keyboard Style	Full-Size Typewriter Style	Flat Plastic Membrane	Full-Size Typewriter Style	Calculator Style
Number of Keys	66	57	48	53
Programmable Function Keys	4	0	0	0
Graphic Symbols On Keyboard	62	0	0	0
Displayable Characters	512	256	192	256
Microprocessor	6502	6502	TMS9900	6809
Accessible Machine Language	YES	YES	YES	YES
Upper/Lower Case Characters	YES	YES	YES	NO
Operates with all Peripherals (Disk, Printer and Modem)	YES	NO	YES	YES
Full Screen Editor	YES	YES	YES	NO
Microsoft Basic	Standard	N/A	N/A	$ 99.00
Telephone Modem	$110.00	$399.95	$450.00	$154.95

*Manufacturer's suggested retail price Mar. 1, 1982



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1 April '81 issue 2 May '81 issue 3 November '81 issue 4 Fall '81 issue

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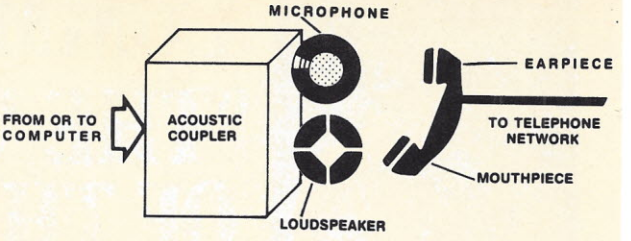
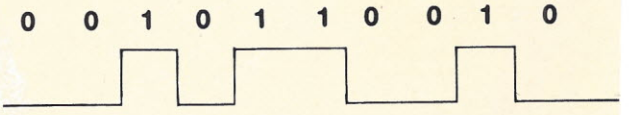
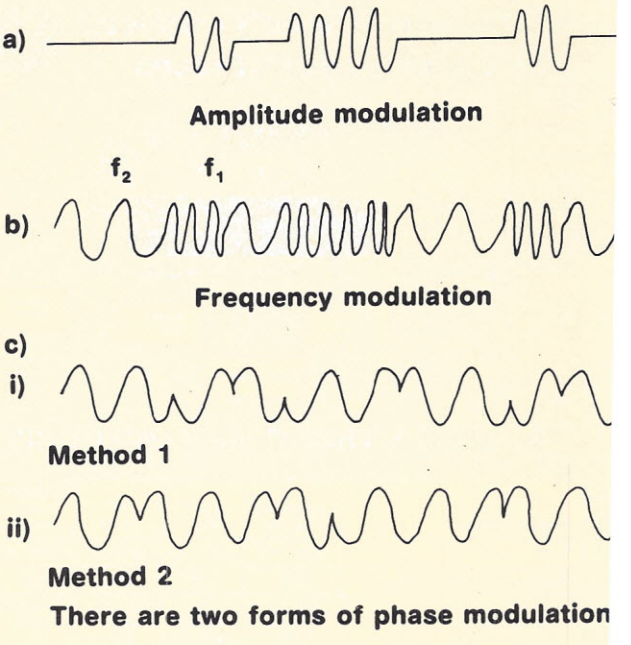


Figure 4. Operation of an acoustic coupler



Unmodulated digital signal (0010110010)



There are two forms of phase modulation

Figure 5. Use of modulation techniques

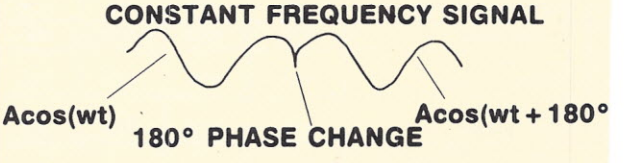


Figure 6. Use of 180° phase change

operator there would need to pick up the telepho handset and place it on the coupler.

A simple connection between two telephones involv only one pair of wires, as shown in figure 7a. When o two wires are used, the signals from party A to party B a on the line simultaneously with the signals from party

Continued on page 1

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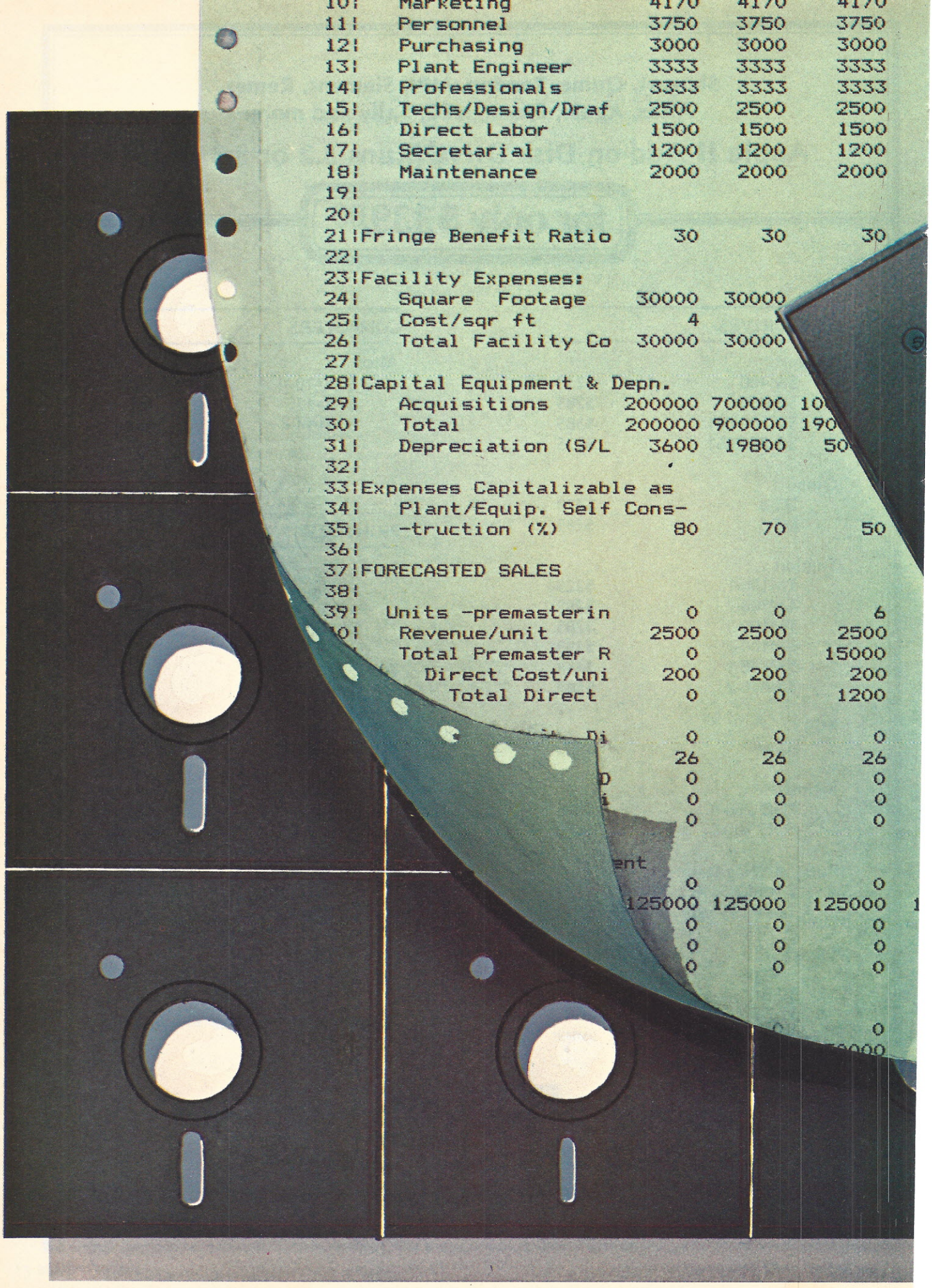

10	Marketing	4170	4170	4170
11	Personnel	3750	3750	3750
12	Purchasing	3000	3000	3000
13	Plant Engineer	3333	3333	3333
14	Professionals	3333	3333	3333
15	Techs/Design/Draf	2500	2500	2500
16	Direct Labor	1500	1500	1500
17	Secretarial	1200	1200	1200
18	Maintenance	2000	2000	2000
19				
20				
21	Fringe Benefit Ratio	30	30	30
22				
23	Facility Expenses:			
24	Square Footage	30000	30000	
25	Cost/sqr ft	4		
26	Total Facility Co	30000	30000	
27				
28	Capital Equipment & Depn.			
29	Acquisitions	200000	700000	10
30	Total	200000	900000	190
31	Depreciation (S/L	3600	19800	50
32				
33	Expenses Capitalizable as			
34	Plant/Equip. Self Cons-			
35	-truction (%)	80	70	50
36				
37	FORECASTED SALES			
38				
39	Units -premasterin	0	0	6
40	Revenue/unit	2500	2500	2500
	Total Premaster R	0	0	15000
	Direct Cost/uni	200	200	200
	Total Direct	0	0	1200
		0	0	0
		26	26	26
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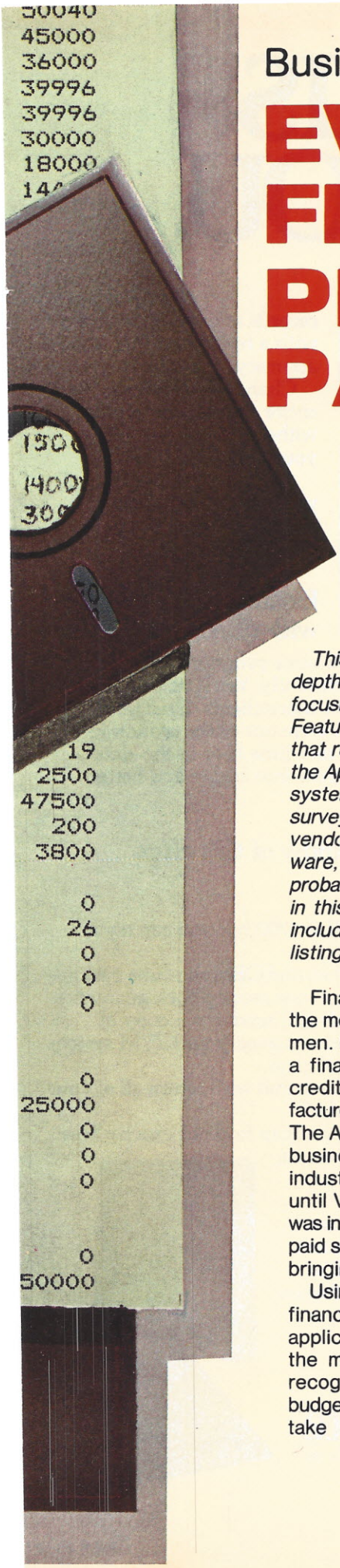


Business Software Forum

EVALUATION OF FINANCIAL PLANNING PACKAGES

by Carl Heintz, CPA

This month we continue our series of in-depth reports on microcomputer software, focusing upon financial modeling packages. Featured are packages ranging from those that run on standard-size micros such as the Apple, to those that run on large micro systems like the DEC Vax machine. Our survey was conducted by polling software vendors to inquire about available software, then compiling the results. There is probably some good software not included in this survey. An effort will be made to include packages that eluded this month's listings in forthcoming updates.

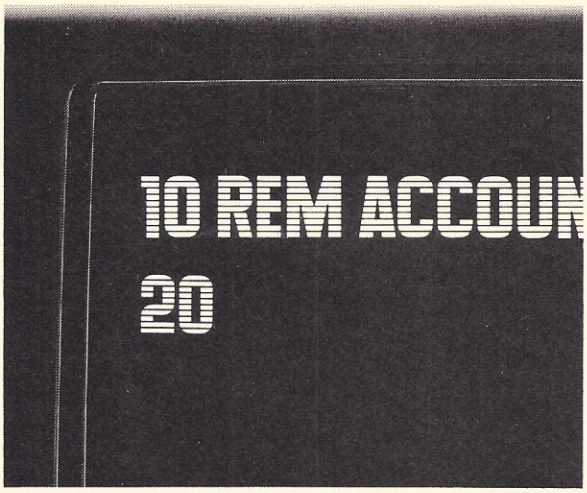
Financial planning programs are among the most popular applications for businessmen. In some instances, the popularity of a financial modeling program has been credited for aiding microcomputer manufacturers to penetrate the business market. The Apple micro may have been a capable business machine all along. But many industry observers contend that it wasn't until Visicalc (by Visicorp, San Jose, CA) was introduced that the business community paid serious attention to the practicality of bringing the micro into the office.

Using a computer to prepare interactive financial plans and budgets is not a new application. Early in the development of the mainframes, business programmers recognized the need to prepare plans, budgets, forecasts and analyses that could take into account numerous "what-if" situations. Many of the timesharing services offered financial modeling programs, including General Electric's FAL and FAL2, and Computer Sciences modeling languages. Many early planning tools were mere adaptations of engineering design tools that had been developed to aid engineers in working out complex design models. Most of them were mathematically oriented—elegant number crunchers in the fashion of a higher-level Fortran.

There have been a number of different approaches to financial planning on a micro. Some vendors have attempted to down-scale or emulate products that run on larger machines. The other approach has been to design from the ground up, utilizing the special capabilities and limitations of the micro machine. Within these contexts, there appear to be two design philosophies: the language-oriented and screen-oriented programs.

A screen-oriented program uses the micro as a giant electronic worksheet. The user constructs a model using available internal memory. This memory imposes restrictions on the size of the worksheet that can be constructed. Disk memory is utilized for filing and retrieving, but generally plays no part in the size of a model. In essence, disks are used for archival storage. This approach is simple and works well for most situations. Users construct models using the screen as a guide. Visicalc and Supercalc are good examples. The

BOY, IS THIS COSTING YOU.



It's really quite basic: time is money.

And BASIC takes a lot more time and costs a lot more money than it should every time you write a new business software package.

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But it's only fair to warn you: business programmers don't go back to BASIC's.

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program gives the user a "blank page" divided by rows and columns. Each coordinate location is then defined by the user—either as an alphanumeric comment or a label (row descriptions) or constants (numbers) or formulas that relate amounts or other coordinates to each other.

The electronic worksheet approach is used by the majority of the products surveyed. Of these, most are designed as original products designed for a specific micro. Many of the products are similar in overall orientation to Visicalc, and are sometimes unfairly labeled "visiclones." While most of the electronic spreadsheet products share general characteristics, there are subtle but interesting features differentiating them.

The other philosophy of financial modeling appears to have evolved from many of the programs available on

Many of the products are similar in overall orientation to Visicalc, and are sometimes unfairly labeled "visiclones."

PROGRAMMER'S AIDS

This month we focus upon two outstanding utility programs that should be in the arsenal of everyone who deals in writing applications programs in MBasic, CBasic, CB-80, Pascal, PLI and Fortran-80 on an 8080 or Z-80 machine. The programs are Autosort and Fabs from Computer Control Systems (Largo, FL).

Writing customized programs on your own micro is a challenge and sometimes a pleasure. Despite the large number of database languages and the availability of program generators, many micro users prefer to "roll their own." Of course, such an endeavor is not for the novice, and shouldn't be attempted without understanding the time and effort required to bring it to fruition.

The biggest problem with writing a program in Basic, for example, is that no matter which dialect you use, there remains a gaping hole. With the exception of OASIS Basic and SBasic, micro languages are essentially devoid of any sophisticated file-handling capabilities. In other words, the languages provide the user with the capability of getting information into and out of files but provide little assistance in the manipulation of those files or their records. This poses a tremendous problem for any serious programmer.

Consider a general ledger program written in MBasic. The program creates sequential transactions files. They are in the order of creation. That is fine until it comes time to organize the data by account—for the general ledger. To do so requires a sort program. There are many programs that can be written in Basic to sort the data, but they all share one common flaw. They are characteristically slow. If there is any real volume of transaction data, the effort is wasted—a manual system is more efficient.

To provide another example, an organization maintained a mail and address program used to keep track of membership. The programs were written in Basic and ran on a Micronova with a 10M-byte hard disk. There were 30,000 members. To sort them required over eight hours of computer time. Such a system was virtually unusable since frequent updates of the membership were necessary.

The solution was to use an assembly language sort program designed for greater speed. To invoke the program, the operator was required to leave Basic and go to the operating system level. Returning to the example of the general ledger system, the operator would be required to exit the Basic language and execute the sort, then return to Basic.

While this may not discourage a competent operator, it can cause havoc for a novice. There are ways to have the Basic program call the assembly language program, but getting to it is not as hard as getting back to the Basic level. The reason so many novice programmers stop attempting to program meaningful applications in Basic is due in part to the difficulty in handling sort functions.

The logical solution to the problem is to use a random file. You can access any record by record number. The problem comes in making such an arrangement work in an application without some intricate programming. One has only to list the "MARIS" section of any of the early Peachtree programs to note the sophisticated programming required for implementing such a scheme. (Peachtree is given here to show how one vendor attempted to solve this very real problem. Some never tried to solve the problem. Structured systems, in their earlier programs, required the user to run a sort program right from the operating system. The programs, written in CBasic, brought the user to the operating system after each program section.)

You would think that a task as essential as handling files would have been addressed adequately by dozens of companies—not so. While there are a number of good sort packages available, Supersort and Qsort among them, most vendors kept them as stand-alone packages. In the place of good file handling utilities, there were dozens of database applications programs, such as DBase II and FMS-80, which incorporate file-handling capabilities into a higher level language. In doing so, these packages

Continued on page 82

mainframes and the major timesharing services. This ancestory does not offer any implicit advantage. However, it does result in an entirely different orientation. Early financial modeling programs were adaptations of engineering modeling applications that featured a super-Fortran (or formula language) approach to constructing a model. While all modeling packages utilize formulas, the screen-oriented programs concentrate upon *coordinates* and their relationships to each other. The super-Fortran programs specify *variables* and their relationships. DSS Finance and Plan Master are examples. The user constructs the model by writing a program in a "super language," independent of the screen or the coordinates. The ancestors of these programs were oriented to machines that had little, if any, capability for interactive graphical display. FAL2, for example, is a timesharing application that runs in a batch mode and is designed for users who have little more than a KSR-33 (teletype machine). The conceptual differences express themselves in interesting ways. Generally, the screen-oriented modeling programs include more extensive editing and aesthetically-inclined formatting. The formula-oriented programs are often easier to grasp from a logical standpoint—especially if the user has a background in programming.

Obviously, the choice of a specific program is contingent upon many factors. The initial step is to decide what the program will be used for and what machine it will be used on. If you have a Cromemco and will use the program for engineering calculations, then Plan Master is ideal.

Programmer's Aids *continued*

comply with many needs, but they also create problems. Consider, for example DBase II. While the file handling capabilities are extraordinary, the language does not provide for matrices. Any initiated Basic programmer knows that matrices are among the most useful of programming tools.

Computer Control Systems (Largo, FL) has come up with two impressive programs. Even if your interest in programming is sporadic, these programs are worthy of addition to your library.

The first, Autosort, is an assembly language (8080 or Z80) program that is callable from the applications language. The program dumps out what is in memory, calls in a sort program and (when done) reloads the applications language program and leaves everything—except the sorted file—as it was before. The program can function as a subroutine of the applications language. In the case of Basic, the user finally has a sort routine that is a subroutine—every bit as part of the language as PRINT. The program is in assembly language. It uses almost all of the available system RAM for sorting (typically about 44K bytes). As a result, the program runs thousands of times faster than a Basic language sort on medium or large files.

The system has some unusual features. Records of virtually any length can be sorted. There is no limit on the allowable file size that can be sorted. Records can be sorted on up to ten simultaneous keys, either ascending or descending on each key independently. Up to four independent select keys can be used to delete or retain records. The system can pause for disk changes mid-sort, and can interact with user for this purpose. Files can either be merged, overlaid or new files can be created. If an error occurs, the system does not bomb, but returns to the basic program from which it was called with an error message code that can be used as a variable to branch in the program.

The program is relatively unimpressive until a medium size file is encountered. On the system tested, it sorted a complete disk full of information in less than three minutes. That is impressive. Using a program such as Autosort makes writing an applications program an easier task and results in better running programs. At a price of $150, the program is a bargain.

Most sophisticated programmers consider sorts a regression. Besides not being fashionable, it is somewhat limiting to have to sort data in some situations—particularly in an application in which a record must be looked up periodically. In such a situation, a file management program is needed to allow the user to find a particular record by a key. That is the primary idea behind ISAM (indexed sequential access method) files. ISAM file management systems are efficient but slow. There are better methods, but most programmers have neither the time nor the sophistication to implement them. Therefore, they resort to a database system to accomplish what an application language—such as Basic—cannot.

Computer Control Systems solves that problem in a program called Fabs. Like Autosort, Fabs is designed to tack-on to the applications language. What it provides is the kernal of a complete B-tree database system. With a file of up to 65K bytes, the average access time is about one second. Data record keys are kept in a key-sequential, multipath, balanced key structure. Keys never need re-sequencing and the key file is totally independent of the data file. Duplicate keys can be used. With regard to storing and retrieving records, the program will do anything any of the best database managers will do.

Using Fabs is amazingly easy—it is just appended onto the language and becomes a part of it. One note of caution is in order. Fabs utilizes 13.5K bytes of memory—thus some instances may necessitate smaller application program modules or overlays. In a typical 56K-byte CP/M system, for example, MBasic5 leaves the user 25K bytes free memory. The amount of memory after Fabs is sufficient for most applications, but the potential for running out of space is there.

Fabs is not intended to be a complete database management system. It is a tool that a reasonably experienced programmer can employ to achieve the same results as a sophisticated database manager. For those purposes, it represents a unique offering in the micro programming world. It sells for $250.

Anyone serious about writing programs on a Z80 micro should investigate Fabs and Autosort. They are valuable programming tools. ***—CH***

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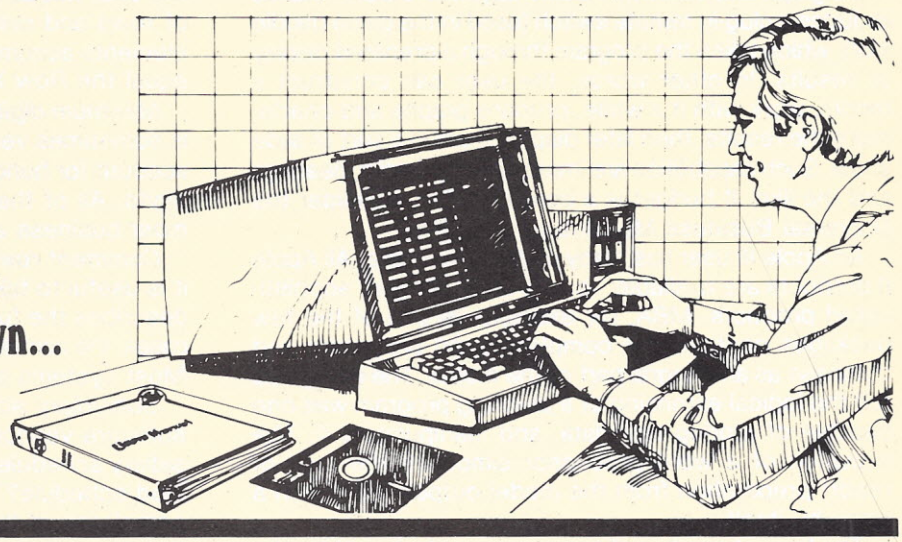

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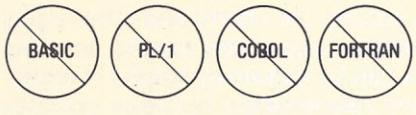

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It is designed for an engineer by an engineer. The program contains little if any "pretty printing" formatting or editing capabilities, but output is completely compatible with Cromemco's word processing program.

If the user has an Apple, Visicalc is not the only alternative. Consider the Universal Business Machine or Micro DSS Finance. Both are valid programs, with widely different features. Micro DDS Finance provides the user with important tools for graphic presentation and interfacing. These must be purchased as extras with Visicalc —Visigraph and Visiterm. Additionally, Micro DSS Finance includes a plug-in remote switch (used in the game paddle slot), which takes the program through a prepared display of results. In other words, the user can construct a model, work with it a while, prepare graphs and charts, store the results, then later display them in a sort of slide show. Such capabilities are impressive for board meetings and the like. If budget is a consideration, consider the Universal Business Machine at only $90.

An Apple III user has many choices available. All Apple II products are available, as well as an array of sophisticated products. MBA, for example, is one of the few packages containing a complete word processor and database as an integral part of the model. The designers felt the logical extension of a planning program was one capable of storing real data, and manipulating it. The inclusion of a word processor simplifies the task of report preparation from the model output. MBA is in a class by itself.

The largest number of programs are designed for the CP/M operating system. These range from Execuplan, which is designed exclusively for the Vector Graphic machines to Microsoft's Multiplan, which runs on just about any CP/M machine. Which is easiest to use? There is quite a range. A product such as Supercalc is very user-oriented. The technical buff who will take the time to read the documentation may benefit from Lifeboat's T-Maker.

A middle-of-the-road product in terms of implementation demands seems to be Calcstar. It has some features worth considering, including the ability to interface with other Micropro software, such as Datamaster and Wordmaster.

The OASIS user will be impressed with the capabilities of the newly released Masterplan. It brings to that operating system's software repertoire a full-featured planning tool. Like Insight (Alpha Micro) and Plan Master (Cromemco), Masterplan uses the system disks for virtual storage—allowing greater capabilities than a memory-only program like Supercalc.

Our advice to the prospective user is simple: try a few of the programs out. The easiest program to experiment with is Visicalc. Virtually every reputable computer store will have an Apple with Visicalc. As a comparison, we suggest a CP/M product such as Calcstar. If you are in a store featuring the Osborne I microcomputer, try Supercalc—which comes standard with the machine. Do not purchase the first system encountered. Many fine products have not received publicity or exposure, but are also worthy of consideration.

The criteria used to evaluate the software on the accompanying charts includes a number of the system's performance features.

Size of matrix. The size of the electronic worksheet is expressed in terms of how many rows and columns may be accommodated by the system. Typically, the figures represent maximums, but the reader is cautioned that it is generally impossible to get both a column maximum and a row maximum at the same time. For example in the case of Visicalc, if one had 254 rows, the maximum number of columns would be substantially less than the theoretical 63. In many cases, the memory of the system plays an important part in determining the maximum size of matrix.

Maximum elements. To effectively compare systems, the user needs to consider not only the maximum size of rows and columns, but the largest number of data elements accommodated. Rarely will this maximum size equal the Row X Column total.

Maximum digits. The arithmetic precision of a system is sometimes very important. Consider a plan that must account for hundreds of millions: 100,000,000.00 = 11 digits. All of the systems have sufficient capacity for *most* business applications.

Comment row. Very often, in constructing a model, it is useful to take a row and write a comment in it that describes the functioning of part of the model. In most cases, the comment will extend past the first column width. Most systems allow utilization of a comment column.

Subsidiary schedules. One question that we asked software vendors was: "Can the system prepare subsidiary schedules and integrate the results into a top or lead schedule?" The inquiry focuses on the potential complexity of the model, and its ability to use information from other sources.

Bomb-out. Nothing is more frustrating than to have a program bomb when machine limits are exceeded. Each of the programs reacts to certain conditions that send it into hyper space. The trick is to understand what these problem areas are and avoid them. Sometimes, such as in the case of Execuplan, it involves ensuring that the calculations don't involve certain illegal and illogical routes. In the case of Visicalc, it means the user must be cautious in establishing large models. Some users have reported that when too large a model is attempted, things tend to "fall off the shelf."

Graphics abilities include bar charts and other visual representations of model calculation results. In many cases, such displays can be extremely helpful in understanding the dynamic relationships between complex data in a model. Some programs offer the graphics in a separate program interacting with the main program.

Split screen. Anyone who has wrestled with an 18-column worksheet knows it is beneficial to be able to fold the paper so that, say columns one and fourteen, can be compared. This is accomplished on an electronic worksheet by a feature known as split screen. Generally, the split screen covers columns, although some systems include split rows as well. This is particulary useful in a case where several computation or intermediate columns exist and the user would like to view inputs in the first column with end results in the last column.

Following are the computational features offered on the system.

Boolean Algebra typically includes the AND, OR, NOR functions that allow a user to construct decision points and some elementary logic flow in a model.

Limits allow the user to place constraints for certain values, either as input or as the results of computations.

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For example, in a production model, a maximum plant capacity might be specified as the upper limit of an algorithm to calculate plant production.

Net present value is a computational feature that saves the user a lot of fancy formula writing, and is particulary useful in the preparation of investment analyses. Using a net present value calculation would be very important in such tasks as determining investment returns for a commercial real estate project.

Cumulatives. Most of the programs allow the user to total up amounts for a range of rows or columns, which also reduces formula writing time. Supercalc, for example, allows one to use "Sum A1:A10" instead of having to write a formula that would look like "A1 + A2 + A3 + A4 . . ."

Squares/Roots. The ability to do exponentials or roots is important in engineering and statistical computation. Since many products have limited facilities in these areas, the prospective user should investigate the programs carefully to assure that they will be versatile enough to handle a specific requirement.

Auto Recalc. When changes are made to a program, it is useful to have a command that will automatically recalculate the entire model. Some systems do this without operator intervention. The user changes a bit of data and the system re-states the rest of the model. Systems vary—some only recalculate from the point of change onward. Others start at line one and redo everything. In complex models, it can make a big difference, thus it becomes imperative for the user to understand the program philosophy of recalculation.

Growing command. All of the packages have commands that allow the user to specify that one column or row will be greater than the preceding one by a certain percentage. Such "growing" commands are extremely useful for calculating budgets or forecasts. Every model includes some implementation of this feature.

Interface input. The ability to interface with other programs—either for data input or output is a primary attribute of any program. Few things are more frustrating than producing a beautiful print-out from a model that must then be re-entered by hand to be integrated into a report being produced on the word processor. Unfortunately, many of the modeling systems have no facilities for outputting results in formats that can be massaged by word processing. A similar situation exists for input. The Visicalc program is a noted exception, with the Visicorp "DIF" format, which allows exchange of files from one program to another.

A modeling program is of little value to most users unless the output is formatted so as to be easily assimilated by the reader. There are a number of common features among the programs.

Justify Right/left. The ability to line up figures in a column is extremely important. Consider, for example the following examples, and how hard they are to read:

```
123.8
45.81
88534
```

A good program should allow the figures to be formatted correctly as follows.

```
 123.8
  45.81
88534
```

Partial print-out. In many cases, when a complex model is produced, the user doesn't necessarily need to print out all of the model. The best programs include a feature allowing the user to print out what it is that he needs, and no more.

Round-off. In the example given above, it would have been more useful had the decimal part of the numbers been deleted and just the whole dollar values presented. In another case, it would be preferable to show $123.12 rather than the calculated $123.11498. Accordingly, a good program will include provisions for rounding off, either cents or preferably to a specified decimal precision.

There are a number of operational features that can make the use of the program more versatile.

Global addressing is the ability to specify a particular point in the model and jump to that point. This is important in putting the model together, debugging it and working with it.

Equation print-out (by coordinate or formula). Just as programmers keep hard-copies of their code, so should a model user keep a list of the formula used to create the model. Different systems respond in different ways. The majority list coordinates (row and column locations) and the formula for a particular location. Others allow the user to list formulas, along with the locations they are used at. Both methods can be useful—depending upon individual needs.

Store data, not model. Some systems allow the user to store data separately from the model. Such ability seems almost universal among the electronic worksheets population.

Mid-model store. When a long model is constructed or analyzed with "what if" situations, it is imperative to have the ability to back it up as you go along. Legion are the users who forget to do so and subsequently lose a model in its entirety due to a power glitch or operator error.

Recover from Disk Errors. Some programs interface well with their host operating system and provide the user with the ability to recover from errors. When evaluating a system, consider the following kinds of errors, and whether or not the program can recover from them:

a) A new model is constructed and you try to write it to a full disk.

b) A disk is removed and replaced with another during processing.

c) A disk has a bad sector that the program attempts to write to or read.

Many programs bomb in these situations. While our survey did not pose these exact questions to vendors, a prospective user should investigate them before purchase.

Paginate. When printing out the results of a model, some programs give the user a paginated (and sometimes numbered) report. While such a feature is not really connected with the performance of the model, it is indicative of the quality of the printed output available.

Look-up data. This ability means that the program can go to an external file and get additional data from it. Consider, for example, one of the most common uses of this feature—an income tax program in which the program makes reference to an external file containing the rate tables.□

Charts begin on page 91

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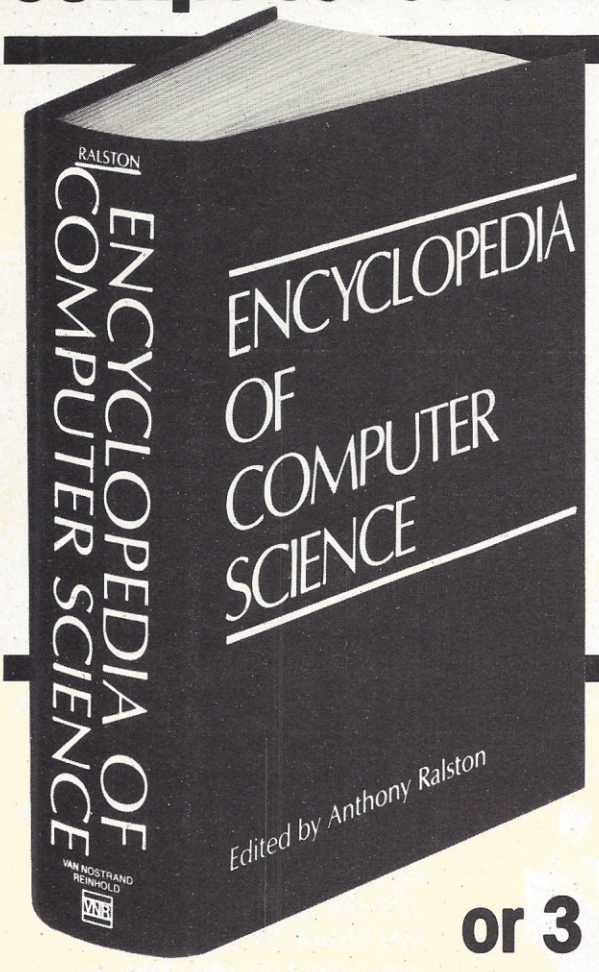

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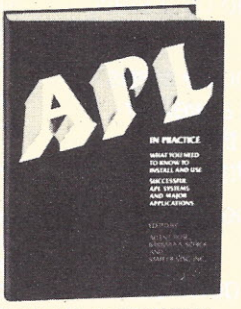

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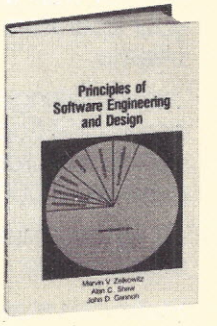

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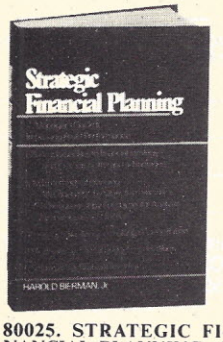

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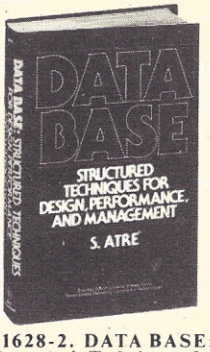

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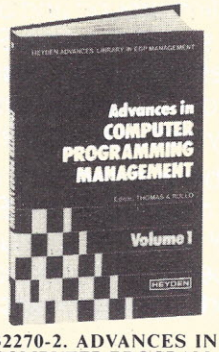

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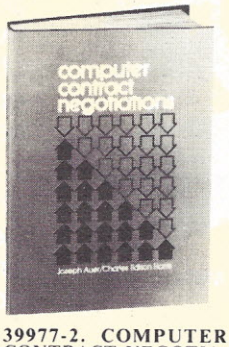

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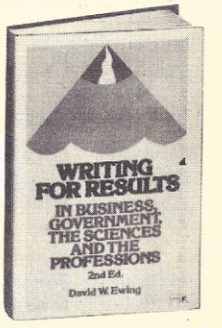

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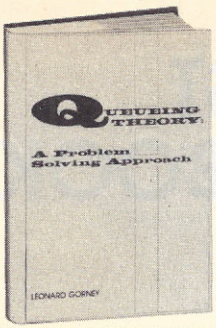

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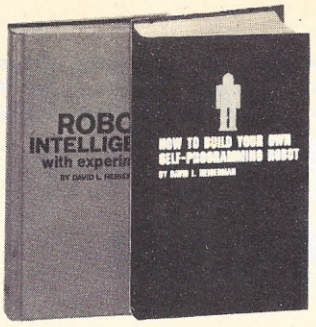

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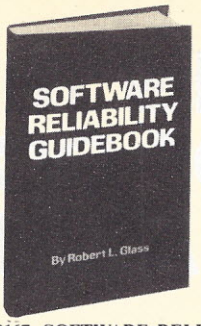

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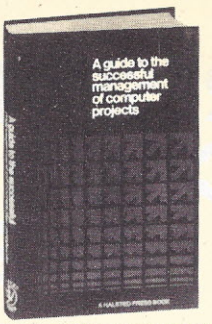

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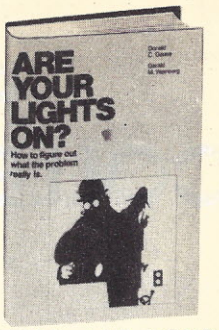

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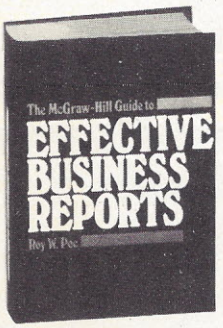

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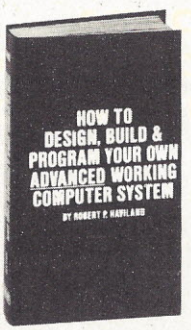

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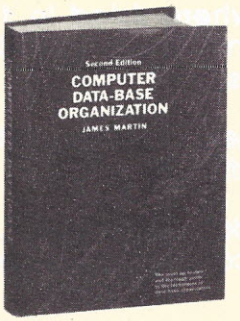

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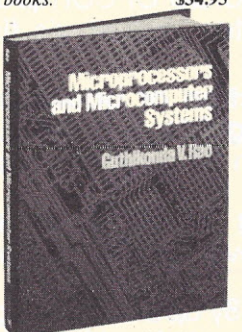

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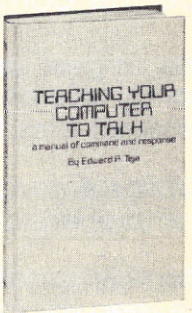

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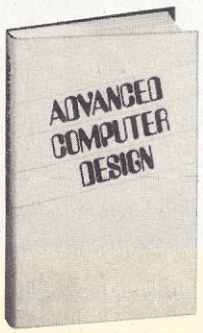

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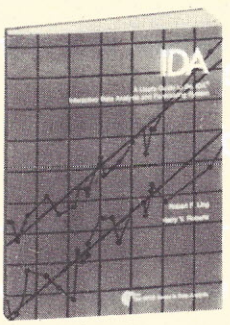

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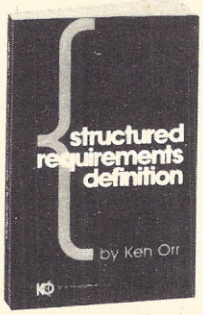

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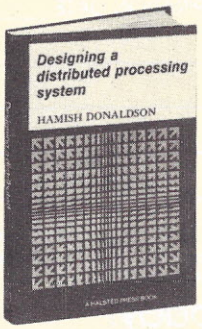

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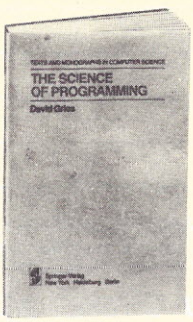

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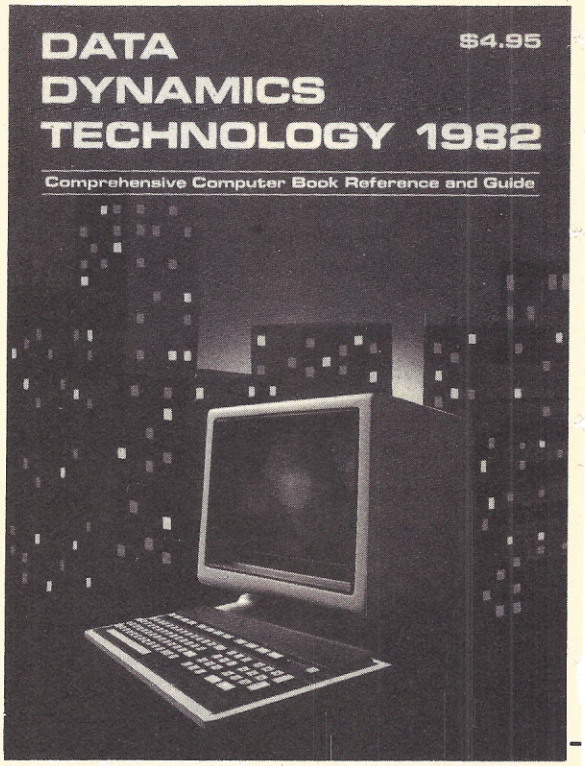

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Intelligent Systems Corp.	225 Technology Park, Norcross, GA 30092	Colorcalc	$199	Intelligent Systems CP/M, 3650 series, 9650 series	Assembly
Lifeboat Associates	1651 3rd Ave., New York, NY 10028	Plan 80	$495	CP/M, Apple, UCSD	Machine
		T-Maker II	$275	CP/M, 48K	Machine
		FPL	$745	CP/M, 56K	Machine
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Microsoft	10700 Northrup Way, Bellvue, WA 98004	Multiplan	$275	CP/M, MS-DOS (both 8 and 16 bit)	C
Peachtree Software	3 Corporate Sq. #700, Atlanta, GA 30329	Magicalc	$300	CP/M	Assembler
Phase One Systems	7700 Edgewater Dr., Oakland, CA 94621	Master Plan	$425	Any OASIS Machine	O Basic
Radio Shack	1300 One Tandy Center, Fort Worth, TX 76102	Spectaculator	$40	TRS-80 Color 4, 16, 32	Machine
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Software Toolworks	14478 Glorietta Dr., Sherman Oaks, CA 91423	Zencalc	$100	CP/M, H 19 Terminal (Heath machine)	C
Sorcim	405 Aldo Ave., Santa Clara, CA 95050	Supercalc	$295	CP/M 2.2 (8080 or Z80) (48K-byte RAM required)	Assembler
Spectrum Software	142 Carlow, Sunnyvale, CA 94087	Universal Business Machine	$90	Apple II, DOS 3.3 48K RAM	Applesoft
Structured Systems Group	5204 Claremont, Oakland, CA 94618	Magic Worksheet	$495	CP/M	Forth
Supersoft Associates	P.O. Box 1628, Champaign, IL 61820	Scratch Pad	$200	Most CP/M	C
Vector Graphic	500 N. Ventu Park Rd., Thousand Oaks, CA 91320	Execuplan	$150	CP/M - Vector Graphic	Assembler
Visicorp	2895 Zanker Rd., San Jose, CA 95134	Visicalc	$250	Apple II, Atari 800, IBM, TRS-80, HP 83-125, Commodore	Machine
		Desk Top/Plan II	$250	Apple II	Basic
Westico	25 Vanzant St., Norwalk, CT 06855	Mini Model	$495	CP/M 48K	C Basic

	Size of Matrix		Max Size (# of Elements)	Max Digits	Comment Row	Subsidiary Schedules	Bomb If Out of Space	Graphics	Color Graphics	Split Screen	Boolean Algebra	Limits
	Rows	Columns										
Supercomp-20	1,000	1,000	1×10^6	16	Y	Y	N	Y	Y	Y	Y	Y
Micromodeler	—	—	32,000	—	Y	Y	N	Y	Y	N	Y	N
Profit-Plan	999	99	1,000	14	Y	N	N	N	N	Y	N	Y
Microplan	999	99	1,000	14	Y	Y	N	N	N	Y	N	Y
Forethought	500	500	250,000	11	N	Y	N	N	N	N	N	N
Plannercalc	3,000	218	3,000	20	Y	N	N	N	N	Y	Y	Y
Target Planner	92	1,000	1,000	6	Y	Y	N	N	N	N	Y	Y
Master Planner	2,500	256	2,500	20	Y	Y	N	N	N	Y	Y	Y
MBA	999	100	99,000	7	N	Y	N	Y	N	Y	Y	Y
Plan Master	1,010	13	13,130	16	N	Y	Y	N	N	N	N	Y
Insight	250	250	64,000	11	Y	Y	N	N	N	N	Y	Y
Micro DSS/Finance	32,000	32,000	32,000	UL	Y	Y	N	Y	Y	Y	Y	Y
Forecast	254	254	254	—	Y	Y	N	Y	N	N	Y	N
Colorcalc	50(5)	52	2,600	14	N	Y	N	Y	Y	N	N	N
Plan 80	512	512	4,200	7	Y	Y	N	Y	N	N	Y	Y
T-Maker II	1,000	25	2,000	10	Y	N	Y	Y	N	N	N	N
FPL	400	400	40,000	10	Y	Y	N	N	N	N	Y	Y
Calcstar	256	256	600	14	Y	Y	N	N	N	Y	N	Y
Multiplan	255	63	MD	14(1)	Y	Y	N	Y	Y	Y	Y	N
Magicalc	254	63	MD	12	Y	Y	N	L	N	Y	Y	Y
Masterplan	UL	56	UL	14	Y	Y	N	N	N	Y	Y	Y
Spectaculator	99	99	3,400	9	Y	N	N	N	N	N	N	N
Logicalc	127	255	500	12	Y	Y	N	N	N	Y	Y	N
Zencalc	254	52	1,500	16	N	N	N	N	N	N	N	N
Supercalc	254	63	MD	16	Y	Y	N	L	N	Y	Y	Y
Universal Business Machine	200	700	1,800	7	Y	N	N	N	N	N	N	N
Magic Worksheet	254	67	MD	12	N	Y	N	Y	N	Y	N	N
Scratch Pad	100	26	UL	13	Y	Y	N	N(1,6)	N	Y	Y	N
Execuplan	254	254	—	16	Y	Y	N	N(6)	N	N	Y	Y
Visicalc	254	63	MD/CD	40	N	Y	N	Y	Y	Y	Y	N
Desk Top/Plan II	300	18	2,700	—	N(2)	Y	N	Y	N	N	Y(3)	Y
Mini Model	DL	DL	80,000	14	N	Y	N	Y	Y	N	Y	Y

Y = yes
N = no
R = right only
L = limited
UL = unlimited
DL = disk space limits size
CD = complexity-of-formula dependent
MD = machine dependent

(1) = maximum column width 32 characters, but 14 digits of precision
(2) = left-hand title column handles 30 characters
(3) = up to 20 custom calculation rules can be user-written in addition to 20 supplied
(4) = file-oriented program. Creates custom Basic routines
(5) = no page numbering
(6) = companion program allows for it

Net Present Value	Cumulatives	Squares/Roots	Auto Recalc	Growing Command	Interface Input	Justify Right/Left	Partial Printout	Round-Off	Global Addressing	Equations Print by Coordinate	Equations Print by Formula	Store Data—Not Model	Mid Model "Store"	Recover from Disk Error	Look-Up Data	Paginate
Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Y	Y	N	Y	Y	Y	R	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
N	Y	N	Y	Y	N	R	Y	Y	Y	Y	N	Y	Y	N	Y	Y
Y	Y	Y	Y	Y	Y	R	Y	Y	Y	Y	N	Y	Y	N	Y	Y
Y	Y	Y	N	Y	N	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
N	Y	Y	N	Y	Y	N	Y	Y	N	N	Y	Y	Y	N	Y	N
N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
Y	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y
N	Y	Y	Y	N	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	N
Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	Y	N	Y	Y	Y	N	Y	N	Y	N	Y	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	N	Y	Y	—	Y	Y
N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Y
N	Y	Y	Y	Y	Y	Y	Y	—	Y	Y	N	Y	Y	N	N	Y
Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N
Y	Y	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Y
N	Y	Y	Y	N	N	Y	Y	Y	Y	N	N	Y	Y	N	N	N
N	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
N	N	Y	Y	N	Y	N	Y	Y	Y	Y	N	Y	Y	N	N	Y
Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N
Y	Y	Y	Y	Y	N	R	Y	N	—	Y	N	Y	Y	Y	N	Y[5]
Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N
Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	Y	Y	N	N
Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
Y	Y	Y	Y	Y	Y	Y	Y	Y	N[4]	Y	Y	Y	Y	Y	Y	Y
Y	Y	Y	N	Y	N	Y	Y	Y	N	N	Y	N	Y	N	Y	Y

A Trio of Useful Hardware Options

by Roger H. Edelson

The Hi-Pad digitizer and eight-pen, multi-color plotting option from the Houston Instrument Graphics Division of Bausch and Lomb (Austin, TX), and the RS-232C DB25 pin reconfiguration adapter from Mountain Computer (Scotts Valley, CA), are this month's topics.

Multi-pen Hiplot option

The eight-pen option for the DMP-7 11-in. by 17-in. vacuum hold-down plotter provides black, red, blue, green, violet, orange, brown and yellow.

The option is available in the form of field retrofit kits, $395 for the six-pen model and $495 for the eight-pen unit. Early models of the DMP plotters required factory return for installation because the original design of the pen holders on these models did not allow automatic pen interchange.

The only minor problem involved with adding the multi-pen option is achieving correct adjustment of the pen pressure. There must be sufficient pressure to eliminate pen skipping at high plotting speeds—but too much pressure will decrease pen life and contribute to line broadening. Once appropriate pressure is obtained, there seems to be no significant drift of the setting, so it is probably only necessary to perform adjustments upon plotter initialization.

Once the multi-pen option has been installed, there are some minor changes in the plotter software and the self-test pattern. The new pattern is considerably less busy than the non multi-color pattern. It tests electronics, controls, pen positioning and the multi-color plotting capability. With the addition of the multi-pen option a new command—pen select—becomes operational. The format of this command is "Pn", where P is the pen select directive, and n is a single digit (1 to 8) that identifies the stall location of the desired pen color. When n = 0, the currently active pen is returned to its respective stall and the now-empty pen holder parks at the "HOME" position.

The plotter is sufficiently intelligent that when a new "P" command is entered during a plotting operation, the Hiplot will return the currently operational pen to its respective stall before selecting the new color. This prevents damage to the multi-pen stable that could occur if a currently operational pen is smashed into an occupied stall when a programmer forgets to reset the holder.

Additional protection is provided automatically when adding the multi-pen option by the establishment of "soft limits" on pen movement in all four directions, which ignore any command to plot outside the normal plotting surface area. Also, the manual modes on the DMP-4 and -7 are disabled after plotter SELECT, and remain disabled until the plotter is RESET.

In order to insure protection of the multi-pen stable, there is one note in the user manual that must be observed: "The Multi-Pen Hiplots expect the pen holder to be empty after a power-up or a RESET command. Therefore, to save time and trouble, make a habit of issuing the PO command at the end of each plotting session."

The plots look excellent and really perk up a presentation. This increased clarity and visibility is achieved at only a slight additional cost in programming complexity, and it is definitely worth the cost of the option.

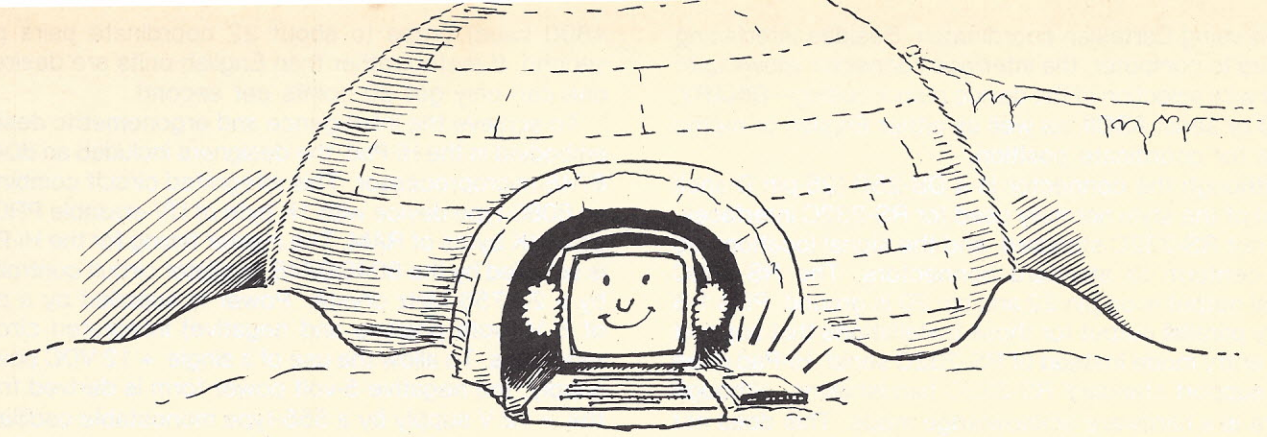
Hi-Pad digitizer

Are you working in CAD/CAM, medical X-ray, photographic analysis or another field requiring precise input of graphic data to a computer system? If so, the Hi-Pad Digitizer is a cost- and time-effective alternative to manual keyboard entry of coordinate position information. The Hi-Pad digitizing tablet/pad is a viable device for converting graphic information into digital data to be used by a microprocessor with high accuracy and significant immunity from operator entry error.

The unit provides an 11-in. by 11-in. translucent surface. If desired, it allows backlighting to eliminate glare and minimize operator fatigue. A combination of digital and RF techniques are used to establish the cursor/stylus position identification with a maximum resolution of 0.005-in. (a 0.01 resolution mode is selectable if desired). This technique, with buried conductor/radiators allows the unit to be UL-listed and also meets FCC Class B standards. One can easily simulate a keyboard if desired, and with the proper programming, one can substitute the Hi-Pad for inaccurate joy sticks—even adding proportionality to the simulated stick position.

While the unit has a specified resolution of 0.005-in., the accuracy of any inputted point is +/– 0.015-in. with respect to the user defined origin. This accuracy drops slightly when the 0.01-in. resolution mode is selected, but is still adequate for most applications.

Specifications indicate that the Hi-Pad provides a flexible coordinate system with user selection of a Cartesian coordinate scheme using either a relocatable, or fixed, origin through hardwire jumpers at the interface connector. The relocatable origin allows use of oversize graphic pieces simply by moving the object to be digitized, then resetting the origin. The relocatable origin also allows coordinates to be positive and negative with respect to any desired point—absolutely necessary



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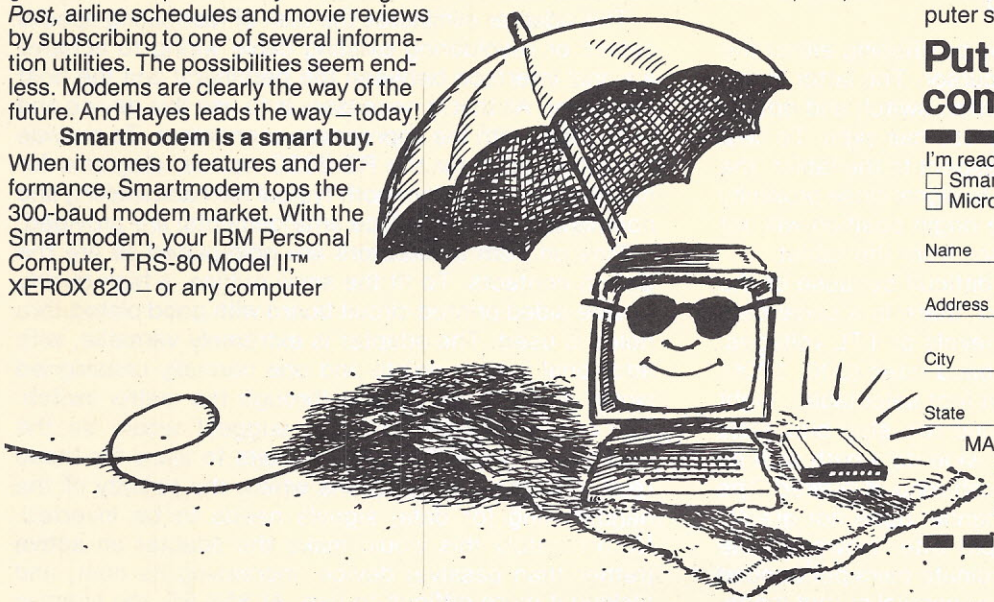

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when using Cartesian coordinates. Besides interfacing Hi-Pad to computer, the interface connector allows user hard-wire selection of the device output coding—BINARY, BCD or serial ASCII, as well as either English or metric units for coordinate position.

Although the connector is a DB-25P (25-pin D-shell type) of the style normally used for RS-232C interfaces, it is not RS-232C standard, and the signal locations do not conform to standard connectors. The RS-232C serial output is on pin 22 and pin 20 is ground. Pins 1-8 carry parallel output for those installations that support this entry mode instead of RS-232C serial. Hi-Pad does not support standard RS-232C handshaking, although there is a hardware acknowledge mode. This does not adversely affect unit operability or usefulness.

It would be nice if the Hi-Pad provided a software controlled option selection mode. This would require a change in connector interface and electronics, but would enhance the unit's flexibility. Such a modification would undoubtedly raise the Hi-Pad's $795 price tag.

Operation of the Hi-Pad is simple. It is self-powered, requiring only 5 watts maximum from the AC line-transformer. It may be powered from the host computer system by providing 12VDC (+/– 10%) at 250 mA (max.) to pin 14. The Hi-Pad is protected against a reverse polarity voltage source by an internal diode. If you favor 230 VAC, you can obtain the Hi-Pad with this power option—on special order.

To use the tablet, place the material to be digitized on the pad surface. Clear and reset the origin. Then begin the coordinate input procedure. The digitizer can operate with non-metallic materials of up to 1/8-in. in thickness, and even work with metallic (but non-ferrous) items. Of course, this is contingent on type and thickness. Once the origin has been established by depressing the combination switch/indicator RESET pushbutton, it is necessary to chose the desired digitizing mode. Three additional combination pushbutton-switch/indicators are provided for this selection:

POINT—coordinates of the selected point are entered only once each time the cursor button is pressed.

STREAM—coordinates are entered continuously.

SWITCH STREAM—digitizing occurs continuously when the cursor button is depressed.

Data entry is accomplished by positioning either the standard stylus or the optional cursor. The latter incorporates an independent pushbutton switch and optical magnifier with a high precision cross-hair sight. To help locate proper positioning with respect to the tablet, the RESET switch/indicator will light to signal close proximity of the cursor to the tablet. The origin position will not be lost upon lifting of the cursor from the tablet.

Interfacing the Hi-Pad is not difficult because of the options provided. As mentioned, there is a serial data interface with either RS-232C levels or TTL voltages. This output is available in four baud rates (300, 1200, 2400 or 4800) with *one* start bit (not selectable), eight data bits (also not selectable) and two stop bits. Data is also available on an eight-bit wide data path with an ACKNOWLEDGE strobe for handshaking, if desired. The timing of the parallel output channel does not greatly affect the digitizer's data output rate. However, the maximum data rate of 100 coordinate pairs per second can only be obtained in the binary-parallel output mode. If the serial mode is selected, the data output rate (at 4800 baud) drops to about 22 coordinate pairs per second. If metric rather than English units are desired, one can only get 20 points per second.

To achieve the intelligence and ergonometric design embodied in the Hi-Pad, the designers included an 8048/8748 microprocessor. This integrated circuit combines an 8080-type device with 1K byte of UV-erasable PROM and 64K bytes of RAM. The master timing for the Hi-Pad is supplied by the 8048/8748 oscillator circuit controlled by a 2.4756 MHz crystal. Power is supplied by a pair of 5 V (both positive and negative) integrated circuit regulators. To allow the use of a single + 12 VDC power supply, the negative 5-volt power form is derived from the + 12 V supply by a 555-type monostable oscillator driving a diode capacitor regulator. The circuit design is well planned, and adequate filtering is provided to minimize logic switching transients. To allow for servicing, the electronics section is connected to the tablet conductors/radiators and the combined indicator/switches by cables and plugs.

The various format, output, resolution and origin selections, plus the ability to use either a marking stylus or cross-hair cursor, make the Hi-Pad a high performance digitizer for either personal computing or professional use. The Hi-Pad is also available in models that specifically interface with the TRS-80, Apple, or Pet computers. An optional display allows the user to see the value of the coordinate points being entered.

DB25 Pin reconfiguration adapter

If I had only one device available when attempting to interconnect a new RS-232C device to my computer system, it might well be the RS-232C DB25 pin reconfiguration adapter. This unit enables a user to instantly mate almost any serial I/O device to a computer through selective rerouting of the RS-232C signals. It consists of a female DB25 connector on one side of a PC card and a male DB25 connector on the other side. Between these two connectors is the heart of the device—a matrix slide switch that allows instant reconfiguration of the major RS-232C signal and handshaking signals. The secondary signal lines plus the two RS-232C grounds are not routed through the matrix, but run directly between the two connectors.

This adapter eliminates the task of fabricating special cables or resoldering existing cable wiring to achieve a signal interface between the peripheral and the host computer. All that is necessary is to use this device and a flat cable with the appropriate connectors. To provide a starting point for the RS-232C novice, diagrams for matrix switch position (both typical full-handshaking and non-handshaking interface arrangements) are provided.

Pins on both connectors are gold-plated as are the switch contacts. To fit the small outline, a high quality double-sided printed circuit board with good plated-thru holes is used. The adapter is extremely versatile, with additional jumper points and one normally unassigned signal available for routing through the matrix switch. The only modifications I can suggest would be the addition of active RS-232C circuits to allow for those really strange configurations where the polarity of the handshaking (or data) signals needs to be inverted. Unfortunately this would make the adapter an active (rather than passive) device, increasing its cost, and making it more difficult to use. At $59.95, the adapter provides considerable flexibility.□

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ETHERNET Arrives for Micros

by Lawrence C. Hartge, Jr.

Ethernet message station *consists of a DEC VT103 terminal with a plug-in LSI-11 processor. It is also equipped with 3Com's new Q-bus Ethernet controller and UNET software running with the Xenix operating system.*

The proliferation of powerful 16-bit microprocessors is adding true computer intelligence to an ever-widening array of personal computers, office equipment, manufacturing process systems and laboratory instrumentation. The evolution to this phase of computing power has been rapid.

The first major era in the cycle was the proliferation of mainframes during the 1960s. During this time, a single large computer generally handled the data processing needs for an entire corporation. In the 1970s, minicomputer makers championed the concept of distributed data processing, which moved us into the second era. Distributed data processing put the computer power into the hands of the department head or the office manager who actually used it. The current third era, local computer networking, is the evolutionary heir to distributed data processing. It carries the concept a huge step beyond a "computer in every building" to that of an "intelligent work station at every desk." This concept of communication among intelligent machines in an office, manufacturing plant or laboratory is dramatically altering the way computers are used in the 1980s.

The Ethernet network was designed specifically for this new era. It is a coaxial cable communication system that interconnects computers, desktop intelligent work stations and their shared resources. It was designed to be used in a building or campus where the attached devices required an economical connection to a network that could carry traffic at high peak data rates. In short, Ethernet defines the topology, communication medium and access method on which local computer networks are built.

A local computer network is appropriate for microcomputer users whenever they wish to share resources

or information with other computer users (see figure 1). For example, a microcomputer user may not have all the special peripherals that he would like attached to his computer. With a local network, this person could access special peripherals that are available on some other computer within the local network.

Some shared resources might include large, high-speed disk drives, printers and larger computers. Examples of information sharing include shared data files, program libraries and electronic mail. Increased productivity results when users have access to more information using intelligent work stations linked together by a compatible communication network—in addition to saving money via shared resources.

Data is transmitted in packets

The Ethernet specification defines the data transmission rate to be 10 million bits per second. The data is sent in packets that are switched through the network to the appropriate computer or work station, over a maximum distance of 2.5 kilometers. Work stations on the network share access to the coaxial cable transmission medium using an access method called carrier-sense multiple-access with collision detection (CSMA/CD).

This access method is very much like that used in everyday speaking. A person first listens to see if someone else is speaking. If the airwaves are busy, the person waits for a "quiet period." When such a period exists, the person begins speaking. However, should two or more people begin speaking at the same time, there is a collision. This dilemma of simultaneous access to the airwaves is resolved by all people ceasing to speak, each waiting a random amount of time, then beginning to speak again if no one else is using the airwaves.

For Ethernet, carrier-sense means that each station listens to the cable before transmitting. If another station is already transmitting, this station senses the carrier on the cable and defers transmitting until the cable is inactive. All stations share the same coaxial cable; hence, they have multiple-access to it. Each packet of data that is transmitted by a station is heard by all stations on the Ethernet. The intended recipients recognize their address, which is embedded in the packet, and disregard other packets that are not specifically addressed to them.

A collision occurs when two or more stations transmit packets at the same time, causing their signals to be intermixed on the coaxial cable. Each station listens while transmitting and compares what it hears with what it sent. If this is not the same, the station has detected a collision and waits a random time interval before attempting to re-transmit the packet.

The primary components of Ethernet are the coaxial cable, the transceiver and the controllers (figure 2). The Ethernet coaxial cable was specifically designed for Ethernet local computer networks. With an impedance of 50 ohms, this cable has a solid core that is surrounded by foamed die electric, and has four shields. Two of the shields are metallicized plastic and the other two are braided. There is a terminator at each end of the coaxial cable.

The transceiver provides the connection to the Ethernet coaxial cable. It uses transformer coupling to provide ground isolation of the work station electronics from the coax. It contains the line drive/receive circuits, does the signal conditioning and detects collisions. The transceiver is built into a small box that can be installed in walls, above ceilings or under floors.

A shielded, twisted pair of cables connects the transceiver to the Ethernet controller that is plugged directly into the work station. Today there are Ethernet controllers available for a wide-range of computers from small Multibus microcomputers through DEC LSI minicomputers, up to larger DEC VAX computers. The Ethernet controllers convert the serial data from the Ethernet into 16-bit parallel data for the host computer. The controller does buffering, which allows the irregular memory accesses to be synchronized with the steady 10M bits-per-second Ethernet data stream on input and output. The packets are formed in the controller by the addition of the preamble, addresses and cyclic redundancy check (CRC).

Another controller function is the Manchester encoding and decoding of the Ethernet data to provide a self-clocking data stream. Collisions on the Ethernet are detected by the transceiver but are used by the controller to generate a collision interrupt for the host work station. The last major function of the Ethernet controller is that of error detection. A cyclic redundancy check is appended to the outgoing packets and checked on the incoming packets. In short, the controller manages the access to the coax. These three primary components, working in concert with each other, make Ethernet a functional reality.

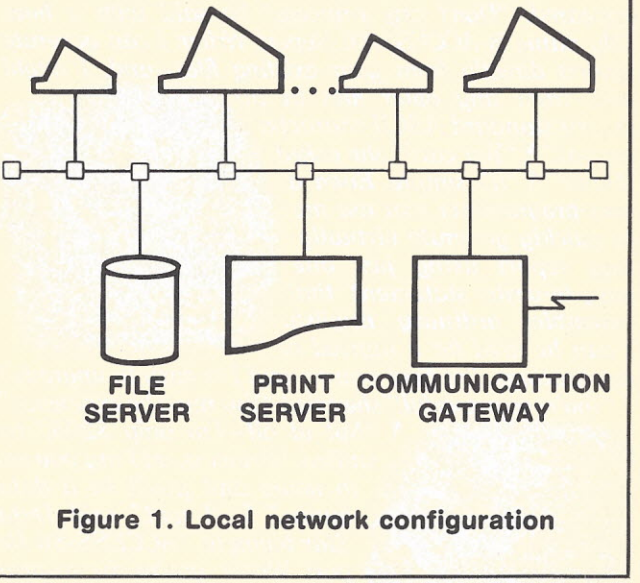

Figure 1. Local network configuration

One of the operational benefits of Ethernet is full connectivity; that is, all resources are connected to each other (see figure 1). This means that all resources can be easily and directly shared among the different work stations. Another benefit is Ethernet's ability to be easily expanded and reconfigured to best fit the user's requirements. Also because Ethernet is a passive bus system, one is assured of a fail-safe operation. A single station going down does not affect the operation of the network.

The Ethernet standard has strong, multi-vendor support. One of the reasons for this support is that Ethernet provides true multi-vendor communication compatibility. Such compatibility is particularly important when one recognizes the fact that no single vendor can provide all the products and services that a company might want to take advantage of. This is evident in the wide variety of equipment throughout our offices and factories today. One of the most important things about Ethernet is that

it is a published standard. By designing products around an existing standard, the entire electronics industry can build products for the consumer. This assures that one doesn't get locked into products of a single vendor. The user is not limited to the learning curve and resources of a single company—as would be the case with proprietary networks.

The Ethernet-compatible product proliferation is beginning as a large and growing number of major manufacturers have accepted Ethernet as the network standard. Some of the manufacturers committed to Ethernet include the original endorsers, Xerox, Intel and Digital Equipment Corporations, as well as 3Com, Mostek, Three Rivers, Altos, Ungerman-Bass, Advanced Micro Devices and Fortune Systems. The European companies include Olivetti, Thomson-CSF, Siemens and Nixdorf.

A published standard means that the resources of the entire electronics industry can be brought to bear upon reducing the cost of connecting to Ethernet. Ethernet controllers for larger minicomputers have been a cost-

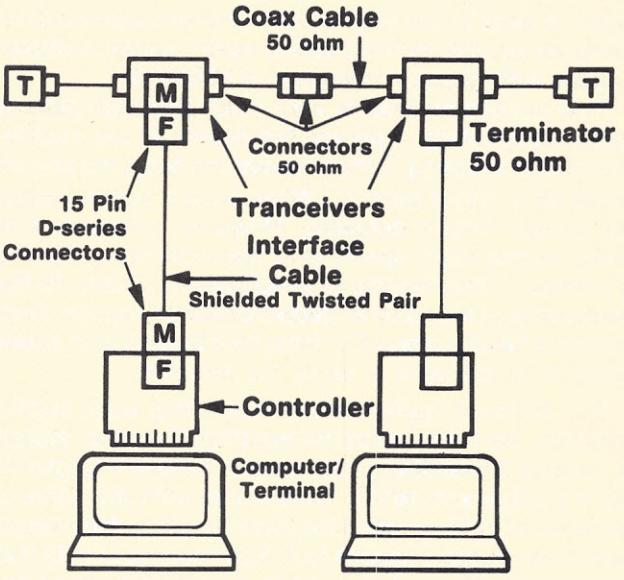

Figure 2. Primary Ethernet components

effective way to do local computer networking since October of last year. However, due to the low cost of microcomputers, it was not until March, 1982 that a controller was available for microcomputers in an affordable price range. Continued benefits from the industry learning curve will accrue as the chip manufacturers working on Ethernet chips bring their products to the marketplace.

Now that we have an understanding of Ethernet, let's examine its place in terms of international standards. The International Standards Organization set up a sub-committee in 1977 to define the open systems interconnect model with a charter to develop the architecture that would be the framework for defining standards that would allow interconnection of heterogeneous systems. A seven-layer model that separates applications from communications tasks was the result (figure 3). The layers support each other in a hierarchy: layer 1 serves layer 2; layer 2 is served by layer 1 and in turn serves layer 3, etc. Each layer performs specific functions and operates independently of the other layers. Ethernet is a standard that specifies the link and physical layers, the bottom two

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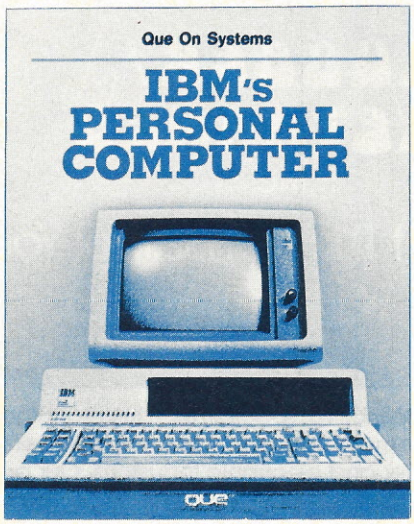

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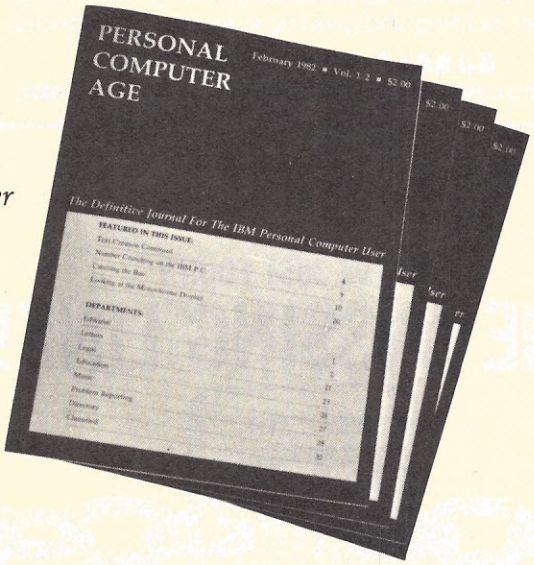

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physical hardware. The upper layers are usually implemented in software and standards are being defined for these layers as well.

Complete standards for layers 3-7 have yet to be agreed upon by the standards committees. However, standards for layers three and four (the network and transfer layers, respectively) have been developed by the Defense Advanced Research Projects Agency (DARPA). These standards, the Internet Protocol (IP) and Transmission Control Protocol (TCP), have been adopted by the U.S. Department of Defense. Yet to be defined are standards for the session, presentation and application layers. Aside from providing services such as switching, routing, end-to-end data integrity, code conversion, etc. what is the functionality of these upper software layers? Let's

International Standards Organization Model for Open Systems Interconnection

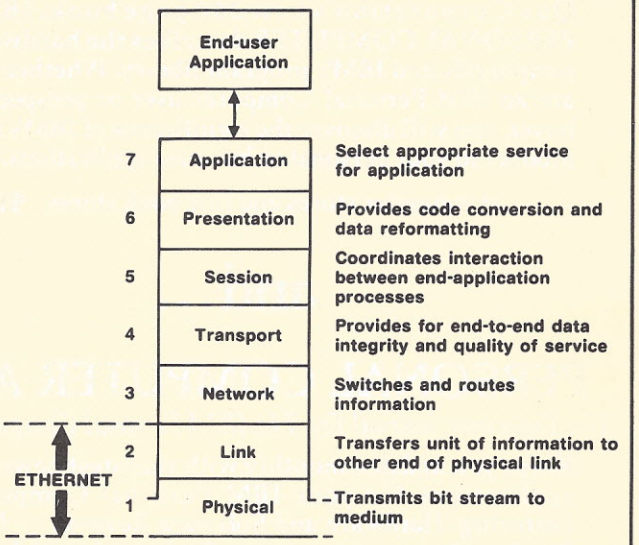

Figure 3. Layered Communication

determine this by examining an actual Ethernet-based local computer network.

UNET, a networking software product developed by 3Com Corporation (Mountain View, CA), works over Ethernet and runs in conjunction with the UNIX operating system. UNET has been adopted by Altos and Zilog in the microcomputer arena, as well as other vendors such as Perkin-Elmer and Tymshare in the minicomputer field. Figure 4 depicts four major functions that are made available to Altos 8600 users via UNET and Ethernet.

The first function that most people take advantage of is remote file transfer. This permits the transfer of files among the computers in the network, and can take place from a work station on an interactive basis or on a job stream basis as command lines. Typically one or more files may be transferred to or from any host with a single command. Some of these transfers invoke action by a remote process. The output of an invoked process may be transferred as a file to the original requester or the file of the original requester may be transferred as input to a process running on another computer that has been invoked.

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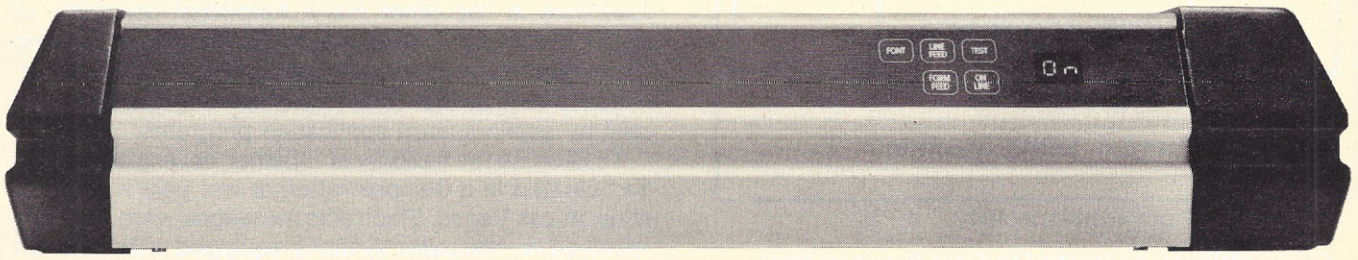

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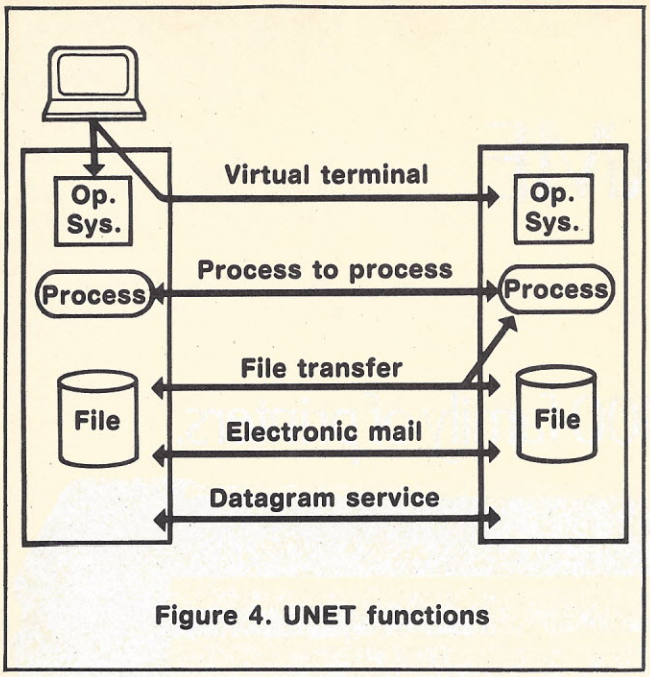

Figure 4. UNET functions

Some of the commands include:

Get—retrieves a remote file from the local host
Put—stores a local file onto the remote host
Mget—retrieves multiple files from the remote host
Mput—stores multiple files onto the remote host
Rename—changes the name of a file on the remote host
Delete—removes a file on the remote host computer

The second major functional capability is that of a virtual terminal connection. Such a connection allows a terminal user at one computer system to access the full power of a remote computer system, just as if they were directly connected to that remote computer. When a connection is established to the remote computer, the initial log-on prompt from that remote computer appears on the user's screen. Once the user has provided the proper security password, characters to and from the local terminal are ferried between the remote system and the terminal automatically.

Sending and receiving electronic mail is another function provided by the UNET software. The mail will be delivered immediately or queued for later delivery, should a link not be available at the time the message is generated. In terms of standards, the message format conforms to the ARPANET standard, RFC #733.

Interactive communication among processes in separate machines is the other major functional capability of UNET. Such capabilities allow independently-operating processes to communicate directly with each other. Process-to-process communication is generally used only by sophisticated application programs.

To illustrate the flexibility of Ethernet, several companies participated in a demonstration at last year's Comdex show in Las Vegas. Electronic messages were sent and received on computer systems equipped with Ethernet controllers and transceivers over a single coaxial cable. In addition to the local network hardware, each computer system was running a UNIX-based operating system plus the required networking software.

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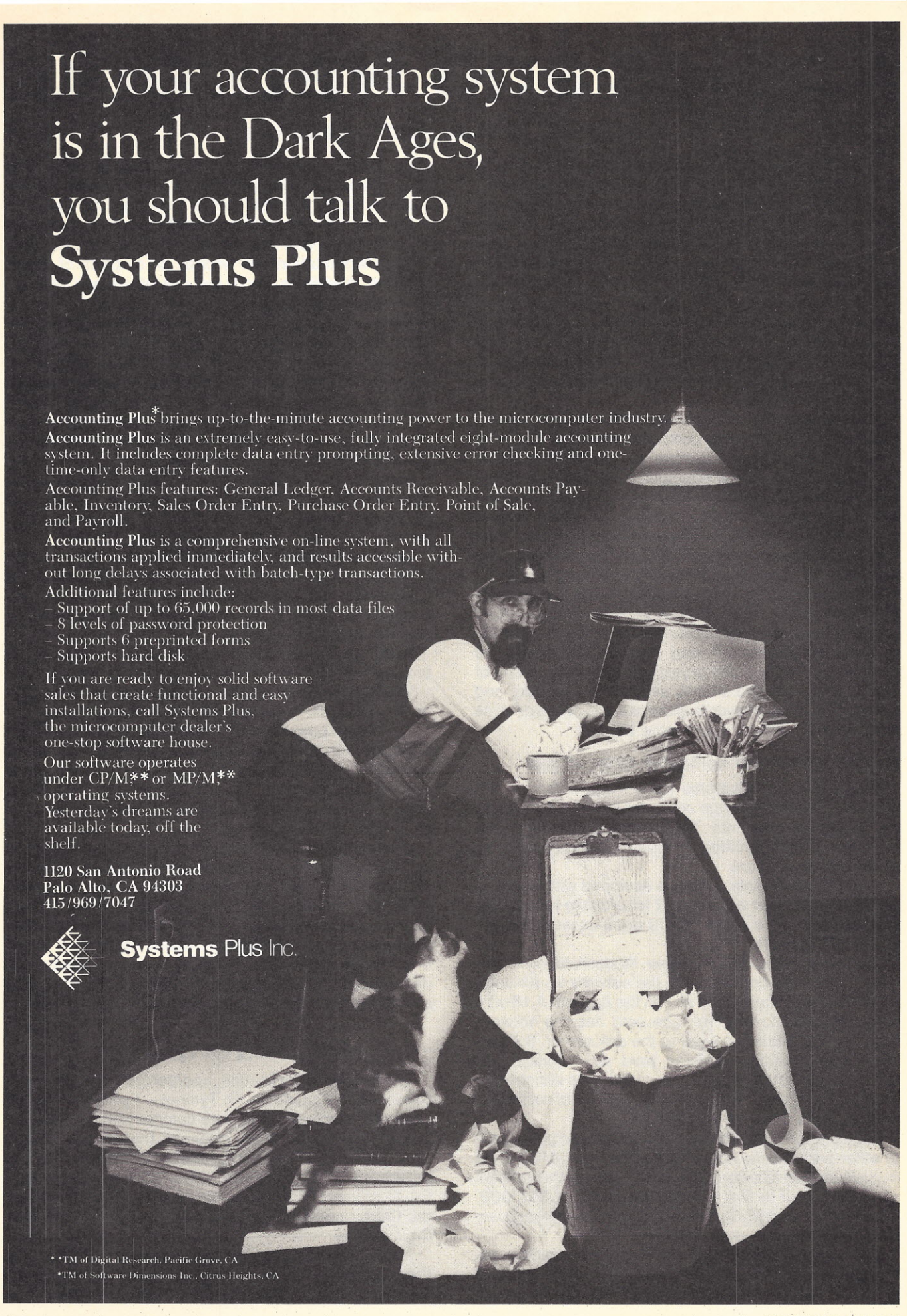

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Apples and Networks

by Dirk van Nouhuys and June Bower

Various networking schemes can add enormously to the efficient operation of many types of businesses. Following are profiles of three businesses utilizing networks in conjunction with Apple computers. Let's discuss factors influencing each implementation, costs and problems involved, and what sort of businesses might benefit from employing similar network configurations.

First, a discussion of various network types is in order. Networks are arrangements for computers to interchange information. A wide variety exist today—from those that transfer massive files from one bank to another in seconds to those that allow a terminal to enter limited commands at typewriter speed.

Most high-speed, widespread networks are packet-switched. A user at a small computer or terminal connects through the telephone system to a nearby network-switching station (node) equipped to receive telephone calls. The user identifies to the node—a minicomputer—what other station he wants to reach. The node collects characters until it has a standard sized packet, then transmits it through a network of like nodes to the second computer. A response returns by reverse-process.

Local networks connect computers within a building or neighborhood by wires. Before microcomputers, there was little need for local networking. Computers were big and sparsely distributed; they reached peripherals like an octopus. Today many organizations have a variety of small computers and shared devices like printers and disk drives. Local networks allow users to share devices productively, without intervening steps.

Nestar network for computer sales offices

Morris Decision Systems (New York, NY) is in the business of selling desktop computer systems to financial and corporate accounts. To increase productivity and creativity, Morris decided to implement the same tools sold to its customers.

The Wall street sales office is equipped with Apple IIs and IIIs that support a staff of 12 for problem-solving and data analysis. Five Apple IIs are used as workstations on a local network.

MDS uses Nestar's Cluster One, Model A network. The workstations are connected to the network via a Nestar interface card installed in a slot on the Apple II. A 16-wire cable attached to the interface card ties the network together. One station is used as the disk server. It allows information transfer between hard disk storage and individual workstations. A 14-in., 16M-byte Winchester provides the storage. The network is capable of supporting multiple hard disks as required.

Each station is tied to the disk server and potentially to other peripherals. A software printer server controls multiple access to external devices. Cost for the network supporting four to five workstations is about $20,000. The cost is about $500 for each additional workstation, excluding the computer itself.

The company uses Nestar to fill two basic needs: mass storage and electronic mail. Hard disk mass storage provides many benefits. The Apple's response time is faster. There are more file backup options available. The user can back up a floppy diskette on the hard disk or use the floppy to back up the hard disk storage.

Beyond, this data management is simplified. Libraries of applications and data can be stored on the hard disk—each workstation can access all or parts of these libraries. In addition, each user can initiate and maintain an independent file library.

Each workstation has an electronic mailbox. Users can send messages and read mail whenever it's convenient. The ability to send multiple copy memos saves much time. Paperwork is eliminated and each person who receives an electronic memo has the option of storing the memo on hard disk, printing the memo on paper, doing both or doing neither. Calendar management coordinates schedules and plans group meetings.

Using Nestar's local network, MDS can also send mail between other local networks. For example, by using the file transfer server, the New York office can communicate directly with the Nestar office in Palo Alto, CA.

Local networks provide offices with three key benefits. First, they facilitate communication. Information can be transmitted to workstations and remains until the user chooses to read or analyze the data. Data can be easily shared, copied or altered.

Also, an economical distribution of resources is provided. Costly resources can be shared. For example, a hard disk storage device can be used by everyone on the network to store data and software libraries.

Finally, the power of personal computers is increased. A broader range of data access is available. Potentially everyone with a desktop computer can be tied into a network and some (or all) of those people might have access to mass storage devices, mainframes or minis to upload or download data.

A small company—such as Morris Decision Systems—can use the network to increase productivity. There is also a place for the local network in a large company. Up to 65 computers can be connected. Each division may have a personal network to provide better inter-departmental communication. Some companies might find it helpful to include a number of people from other departments in the local network to share important data and to strengthen intra-departmental communication.

Tracking railroad cars via Tymnet

The following application incorporates multiple mainframes and an Apple II with Tymnet—Tymshare's international packet-switched data communication network.

Railtrack is a software package that tracks railcars during delivery of finished goods to distribution sites. A database is maintained on a DEC X located in Cupertino, CA. Customers dial a local node on the network to access the Cupertino database to get updates on the status of their railcars.

A Railtrack customer in the Midwest wanted to access the information first thing every morning. The AAR information was handled from the data center in Cupertino, but

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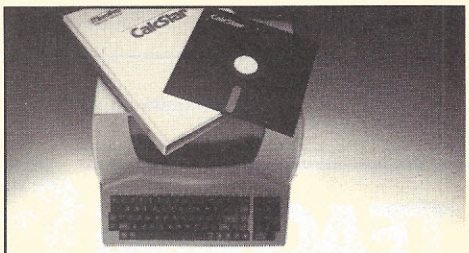

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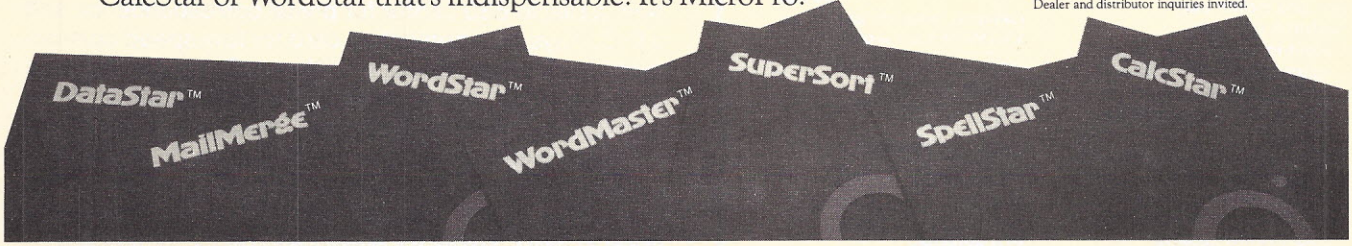


it was the Tymshare application consultant's responsibility to get the Chicago TWX information from Chicago to Cupertino. Instead of getting up at 6:00 AM to access the TWX, Dan Conway, the Tymshare application consultant, used the outdial capability of the Apple II. He programmed the Apple to call the mainframe in Cupertino and instructed it to call the TWX in Chicago. The information was relayed back to Cupertino where it was available to the customer.

The existing hardware was augmented with a DC Hayes modem and a Mountain Computer CPS multi-function card. The card provides a clock device that can be programmed to work like an automatic timer on an oven.

Conway wrote a program that instructed the Apple to wake up at 6:00 AM, then use a local telephone number to gain access to Tymnet's communications node located in Minneapolis, MN. From there, the Apple transmitted the rest of a file of commands that instructed the mainframe to call up the TWX in Chicago. The mainframe was able to call Chicago using Tymnet's outdial capability. Intelligence built into the network currently enables DEC Xs to talk directly with foreign hosts.

The innovative use of a mainframe-micro-network setup was prompted by a common human need: sleep. The Apple was established as a surrogate person in the operation.

The outdial capability of the Apple using mainframes and a network lends itself to many applications. For example, a company might have divisions located a considerable distance from headquarters. The remote locations could send financial or related material to the company's centralized mainframe by way of micros and a network. The mainframe would consolidate and analyze the information—eventually supplying the micro with the processed information. Managers would be able to read reports first thing in the morning, because the microcomputer would be waiting with the results of that night's mainframe processing.

Rather than using a terminal and being on-line constantly, micros might be established as intelligent terminals to access the network and the mainframe-loading and downloading data.

A third application of this technology involves accessing large, proprietary databases. A customer might choose to access certain information databases—such as the Dow Jones—several times each day.

The Electronic Cottage concept

Dean Meyer is a management consultant in office automation. He directs a startup division of the British firm Communicaitons Studies and Planning Ltd. from a cottage in the Connecticut woods. He operates economically and profitably without office staff by judicious allocation of work between Apple II programs and network services.

The distribution of work and modes is displayed in the accompanying table.

The Apple II is equipped with a Videx card for 80-column text, a Diablo 630 printer for postal correspondence and a D.C. Hays communication card for low-speed communication. For high speed, a California Computer Systems asynchronous card and a Bell 212A telephone modem, two disk drives and the shift key mode are provided. All of the programs except one are off the shelf. Tymshare's Augment displays results and receives commands from the keyboard at the distant terminal. Dean has written code in hex (''partly for speed and partly for therapy''), which enables the Apple II to simulate an intelligent

Augment terminal. Dean communicates to clients and colleagues through three electronic mail systems at about 25¢ per copy (counting each copy to each recipient as one in each case).

The electronic mail is not only faster and more reliable, its easy use widens his circle of communication. But reports and proposals are very important to the firm, and for "concept smithing," Dean turns to the Tymeshare system that augments the user's ability to work creatively in writing. Augment offers tools to manipulate outline structure and more facile handling of large blocks of text than is currently available on any personal computer. Moreover, a colleague in Tulsa can look at the same files from his own terminal.

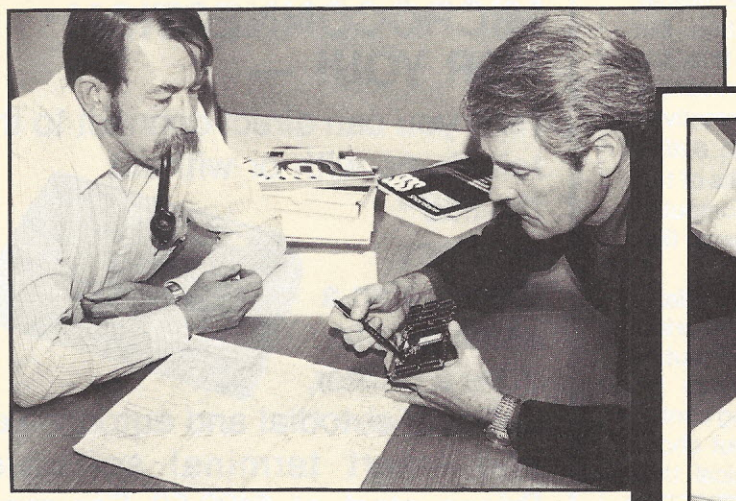
Dean has chosen tools from the large tool kit available for office automation. Sometimes he chooses for price. For example, Augment is too expensive for routine correspondence. So are people; in a previous job wherein he had the support of a word processing center, he did not use Executive Secretary or BIP, but chose them now because they are more economical than clerical help. An MBA from Stanford, he stresses that he chose other tools because they add value to the product; whereas Executive Secretary saves money, Dean can create a better proposal with Augment than he could in any other way. The same holds true for Visicalc, which he uses for financial planning, vs BPI, which he uses to keep books and sees as a way of saving money as compared to an expensive timeshared accounting system or hiring an accountant.

	Local Processing	Network	Other
Bookkeeping	BPI		
Financial Planning	Visicalc		
Calendar Planning		Augment	Paper
Communication			
Postal Letters	Executive Sec		
Electronic Mail		Dailcom MSG Augment	
Telephone			Telephone
Concept Smithing		Augment	
Record-keeping	Diskettes	Augment	Filing Paper

C.S.P. task distribution

Who might take advantage of similar applications? The personal computer tools listed serve common needs for accounting and financial planning and are employed widely. Anyone who depends on substantial documents, particularly in a geographically-scattered organization, might investigate the powerful text-handling tools on networks, which allow scattered workers to share files. Someone who has access to an existing community with electronic mail or wants rapid telegraph-like delivery and recording of messages should use the many electronic mail services. But be cautious: Dean has over 13 years of experience learning computer systems. Even he did not set up his tools as if they were a new suite of furniture; he added the tools one by one over several years. The versatility of a local computer that can act as a gate to varied network services gives great freedom and requires the discipline of careful planning and learning.□

A SYSTEM WITH SAVVY



Excalibur Chief Engineer, Roger Bollman (left) meditates on answers to questions posed by American Business Computers Marketing Vice-President, Joe Mahony. ABC has exclusive rights to Savvy on the Apple II.

Savvy plugs into the Apple II bus

by Dona Z. Meilach

If "You Gotta Have Savvy" sounds like the title of a hit tune, it may well be one you'll be humming enthusiastically in the near future. Savvy—if the people at Excalibur Technologies (Albuquerque, NM) are predicting correctly—will be a top hit and stack up record sales. It may herald a new approach to computer talk. Or conversation. Or interaction. A literal definition of its potential is elusive.

Anyone who has ever punched information into a terminal knows that one must use exactly the correct words, the accurate spelling and sometimes precise grammar before the computer will respond appropriately.

Savvy is a computer card with a Z80 microprocessor or its equivalent, supporting circuitry and an operating system in ROM. The circuit card plugs into an Apple bus as a parallel processor and uses an existing Apple system for memory, display and printing control. It is compatible with DOS 3.3, CP/M and (if the phenomenon catches on) will probably be available for other systems. The board is accompanied by a diskette that understands a small vocabulary of plain words so you can tell it what you want it to do.

Savvy permits a user to phrase commands in a variety of ways, without having to learn new ways of thinking or new vocabularies. If you want to know how much an employee earns, the machine will tell you, regardless of how you ask it—even if you mis-type it. ("How much does Mary make?" "What's Mary's income?" "Whta's Mary csting us?")

This aspect alone has far-reaching significance to the future of computing for the small office. "Our fundamental assumption is that the businessman is not going to (and doesn't want to) change his habits. Many who aren't analytical would prefer not to have anything to do with a computer if it means changing their ways. Instead of making the businessman adapt to the computer, we are giving the machine the ability to adapt to the businessman," explains Nelson Winkless, spokesman for Excalibur. "Up to now, computers have been linked to the analytical—the precise. In essence they are 'left-brained.' They react to purely logical, specific commands and answers," he continues.

"Savvy is different. Savvy can take fuzzy commands, imprecise terminology, incorrect typing, words in different languages—Spanish, French or English—in the same command and return a logical answer. Savvy is 'intuitive,' or 'right-brained.' "

Not only can the businessman deal with the machine in his vocabulary, idioms and terms, the people around him can do the same. The user simply types in a phrase such as "Report the month's sales by regions" and tells the machine to associate that phrase with a program previously written to prepare that report. After the user has associated three or four variations of the same instruction—"Give me regional sales for the month" or "What were sales by region for the month?"—Savvy will assume that a phrase such as "Gimme the regional sales report for the month" means the same thing. You don't have to flounder for exact phrases. If the machine fails to understand what is meant by a new phrase, it can be taught the meaning of that phrase. Savvy always *tries* to be helpful. As user exposure increases, it handles a broader range of topics with more discrimination.

"Think of it as if the machine is going to college and accepting lessons from a teacher, taking notes and providing the answers even when the questions are phrased differently on an exam. The machine is constantly learning from the people who are telling it what to absorb," Winkless explained.

Savvy utilizes adaptive pattern recognition processing, (APRP), which allows arbitrary association of a pattern of input words with some specific output. If you choose,

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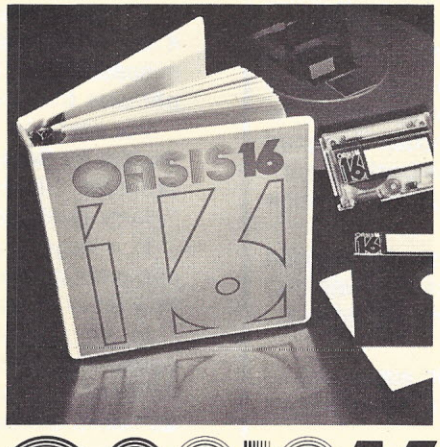

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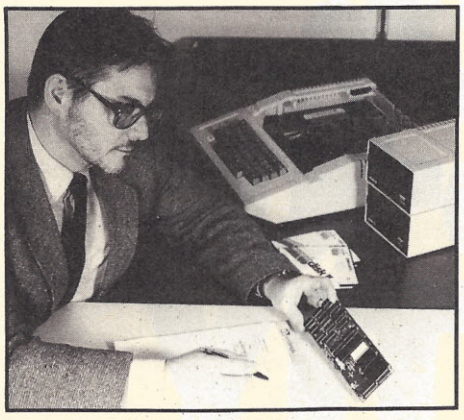

Nelson Winkless
One of Savvy's founders

The Savvy Behind Savvy

Savvy is the brainchild of Excalibur Chairman, James Dowe, a computer buff who claims to prefer spending his time pondering methods of making computers user-friendly to being friendly himself. Pushing 40, Dowe's background includes a degree in physics and mathematics from New Mexico State University, a stint in industry and some years as Associate Director of the University of New Mexico Computing Center.

Nelson Winkless, the spokesman, is one of the founders of Excalibur and a consultant to the company. His entry into computing was accidental when he was inadvertently thrust into the editorship of a computing magazine for a year—despite his background in Russian and English literature and as a scriptwriter in Hollywood for several years. "Strictly right-brained intuitive-creative," he shrugs his shoulders and denies any left-brained statistical or analytical aptitude. Winkless has co-authored two books, *Climate and the Affairs of Men* and *Robots On Your Doorstep.*

James Blackman III, president of the firm, is also relatively new to computers. He has experience in marketing with major corporations. At Excalibur, he is developing the Powerstation—a computer designed for executives. It is "temporarily on the back burner" according to Winkless, "as we gear up for the huge order we have for Savvy."

Excalibur Technologies is inconspicuously housed in an office at the quiet end of a tourist shopping mall in Albuquerque's Old Town. It is informal and friendly.

What is its destination?

If the Excalibur people have their way, they're heading to the top of the hit parade and hope to have a gold disk to show for it.

you can teach German in, and Basic out. Savvy operates as a pattern recognition system and does not focus on pre-determined key words or grammatical analysis.

APRP is a peculiar technology that emulates the neural net of the human brain. Like the brain, we want to be able to feed the computer information in large quantities, store it and let it determine what it needs when it needs it. Compare the process to a desk filled with notes, business cards and newspaper clippings. Such information can be fed into the computer randomly. It will sort it into the appropriate pockets of its electronic brain. You don't have to make categorical decisions, organize and reorganize. The machine does it for you. To retrieve information, you can pose relatively vague questions and receive specific answers," expounds Winkless.

No programming experience required

Savvy does require some input and programming before it reacts to a user's particular idiosyncracies. But even this is more easier done than one would think. One needs no computer programming experience to work with Savvy. A person must be able to tell the system what he wants it to do, but he does so in his words, rather than the rigid, precise wording, numbering, quotes and repeats associated with conventional programming.

It means that an executive with Savvy could access outside data bases to respond to his phraseology or inaccurate typing. With a modem hooked into a stock market source, he could query "Wahts the high for x stokps tday?" and receive a report.

However, Winkless concedes that Savvy is not a cure-all. "It does have some problems and perhaps that's what gives it near-human characteristics. The ability to make mistakes is a necessary part of intelligence. I guess you could say Savvy is smart enough to make mistakes."

The machine is taught phrases similar to the short routines upon which the program is built. The program grows by assimilating information a little at a time, adding to it or deleting from it. Once these short phrases are in the machine, the machine can deal with them, even when questions are phrased in different ways. But if the potential answer has not been entered into the machine, a user won't get it.

The result is that answers are sometimes approximations. Should a wrong answer appear, an operator may not know *where* the machine found the answer or *why* it answered the question incorrectly. Did the machine misassociate? Is there a bug? Did it learn lines and phrases that were ambiguous?

For example, one could inquire if employee Harry was eligible for Social Security. Asked, in context of a payroll program, "Is Harry eligible?" The answer could be, "Harry is single."

In a large system, Savvy will be extremely versatile and practical because it can scan and select information. In a small system, this capability will be more limited.

In its present form, Savvy has a near-100-word vocabulary and requires about 20K bytes of memory. At first it may seem a little frustrating to work with, but as users become familiar with its logic patterns and potential ability, they will discover how valuable an office tool this particular system is. Where else can you find an employee who understands garbled instructions and slurred early morning speech—and never considers walking a picket line or asking for a raise?□

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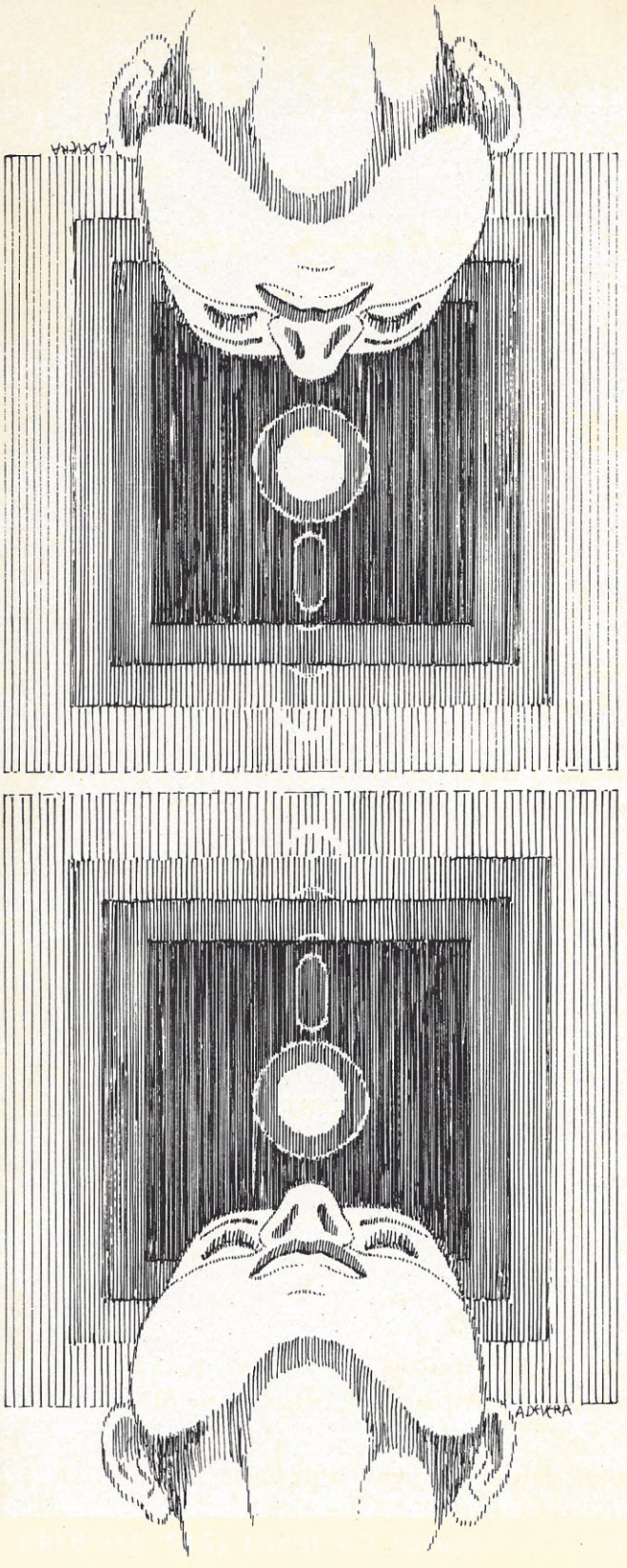


MICROSHELL: UNIX Features for CP/M

by Alan R. Miller

The operating system of a computer is responsible for execution of user programs, hardware operation, organization of files and task scheduling. For several years, CP/M (Digital Research, Pacific Grove, CA) has been the most commonly-used operating system for 8080, 8085 and Z80 computers.

UNIX is an operating system with many desirable features. It was developed at Bell Laboratories for minicomputers. UNIX-like systems are beginning to appear on the 16-bit machines, but UNIX is not available for 8-bit machines. In response to this void, several packages have been developed that bring valuable UNIX features to the CP/M operating system.

Microshell (New Generation Systems, Reston, VA) is a program that runs in conjunction with CP/M. It adds many UNIX-like features while retaining all of the regular CP/M capabilities.

Before looking at the operation of Microshell, a review of the organization of CP/M is important. The computer's main memory is partitioned into five regions. Beginning at the lowest memory address, these are known as: the system parameter area, the transient program area (TPA), the console command processor (CCP), the basic disk-operating system (BDOS), and the basic input-output system (BIOS). These areas are summarized in the accompanying figure. High memory is shown at the top of the figure and low memory is shown at the bottom.

The system parameters begin at address zero. An instruction to jump into the BIOS is placed at the beginning (bytes 0-2). A jump into DBOS is placed at bytes 5-7.

The TPA is usually the largest region of memory. Executable programs reside there. The CCP contains instructions for processing commands typed from the console. This includes the built-in commands DIR, ERA, REN, SAVE, TYPE and USER. The CCP is not needed after an executable program has begun. It is common practice for executable programs to enlarge the TPA by overlapping the CCP region. A warm start at the conclusion of the program will reload the CCP and the BDOS from the system disk.

CP/M will indicate that it is ready to accept a command from the console by displaying the prompt: A>. Microshell can now be executed by giving the command: SH. This directs CP/M to load Microshell into the TPA and give it control. Microshell then moves itself up in memory, overwriting the CCP. Microshell literally displaces the CCP. From now on, the Microshell prompt of % appears rather than the familiar CP/M prompt.

Microshell incorporates all of the six CCP built-in commands. For example, the current disk directory can be viewed by typing: DIR. Most executable COM files can also be run. For example the command: STAT *.* will display the directory in detail.

The powerful file-searching feature of Microshell can be observed by moving the drive B and executing a program located on drive A. Give the command B: to change the default drive. Suppose that STAT is located only on drive A, but the default drive is B. With CP/M, you would have to give the command: A:STAT *.* to execute STAT since it is not present on the logged-in disk. However, with Microshell, the simpler command: STAT *.* can be given.

Automatic file-search

When a program is executed under Microshell, the user's directory on the logged-in disk is searched for the requested file. This action is the same as it is for CP/M. However, if the file cannot be found, Microshell will try to locate the file under user 0 on the logged-in drive. If that is also unsuccessful, Microshell will then look on drive A under user 0.

Normally, if several different user areas are active, there must be a duplicate copy of each executable file in each user area. However, when Microshell is installed, only one copy of each program is needed if it is placed in user area 0 on drive A. The automatic file-search feature will locate it even though a different user area and drive are active.

The file search feature of Microshell also applies to arguments given to executable programs as well as to the executable programs themselves. Thus the command: DUMP DUMP.COM given from drive B will allow the program DUMP to display itself, even though it is located on drive A.

It may sometimes be necessary to disable the automatic file-search feature. For example, you may want to delete a file on drive B. But if the file does not exist on drive B, you don't want to delete a file with the same name on drive A. Therefore, automatic file search can be disabled by giving a command of -F. This is one of several flags used to disable or enable Microshell features. File search is re-enabled with the flag +F. Programs called PIP and COPY automatically disable this feature at the beginning of execution and re-enable it at the end.

Another powerful feature of Microshell is multiple commands. Several consecutive commands can be given on the same line if they are separated by a semicolon. For example, the expression: ERA * .BAK; STAT *.* will erase all backup files, then display the remaining files in alphabetical order.

There are several restrictions on the use of multiple commands. Each command that is separated by semicolons must be written with less than 18 characters. Furthermore, the entire line must be less than 85 characters long.

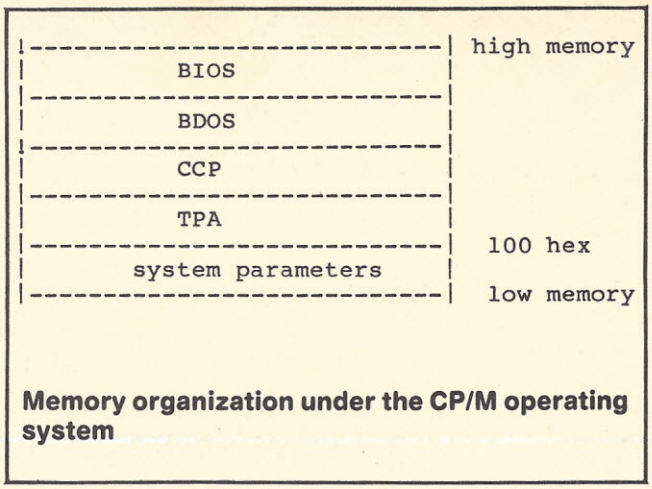
When an executable program terminates with a branch to address zero, CP/M will reload the CCP and the BDOS and will log in the disks. The same thing happens if you type a control-C from the command level of CP/M. However, if Microshell is in operation, it will intercept the restart and simply display its prompt. Of course if an executable program overlays the Microshell area, a branch to address zero will reload CP/M.

If a diskette is removed from a drive and replaced with another, the disks should be logged-in again. This is usually accomplished by typing a control-C. However, when Microshell is in operation, the drives must be reset with the command of -L (for login). This is one of several Microshell flags. Some of these flags have two states. A minus sign in front of the flag is used to turn off the feature, while a plus sign turns it on. In this case however, there is only one state. Consequently, either a -L or a +L can be given. The result is the same. The X flag also has only one state. It is used to exit Microshell and return to CP/M. Either a -X or a +X may be given. Both of these flags must be preceded with a minus sign or a plus sign so that they can be distinguished from a filename of L or X.

Character conversion

All lower case characters typed at the CP/M command level are automatically converted to upper case. However, additional input (after a program has begun) is not automatically converted. Filenames are normally stored on disk in upper case letters. Consequently, if an executable program needs a filename, either it must be entered in upper case, or the program must make the conversion. Some programs can do this and some cannot.

Microshell is initially set to convert all lower-case letters to upper case. However, this can be changed with the U flag. Typing a -U resets the flag, so that all characters are accepted just as they are typed. A +U command restores the flag to its default condition. The operation of this flag can be observed by executing a program called ECHO that is provided on the Microshell disk. This program reprints the entire command tail, that portion



Memory organization under the CP/M operating system

of the command that follows the name ECHO. For example, if you type the line:

– U; ECHO This line will appear in lower case; + U

Microshell will print the line as:

This line will appear in lower case

immediately afterward.

Notice that three separate commands, partitioned by semicolons, were typed on the same line. The first command, – U, disabled the U flag. The second printed the command tail. The third part re-enabled the U flag. Now the U flag is back to normal. Consequently, if the command:

ECHO This line will appear in upper case

is typed, Microshell will respond with:

THIS LINE WILL APPEAR IN UPPER CASE

indicating that lower case input is converted to upper.

The redirection of output is one of the powerful UNIX features incorporated into Microshell. This makes it possible to divert output that is destined for the console to a disk file instead. The greater-than symbol is used for this purpose. For example, the command: STAT *.* >FILES will create a disk file with the name FILES. The file will contain the information that would have appeared on the console.

Of course, no output appears on the console when output is redirected. If you want to see what is happening, you can add a plus sign (+). For example the command: STAT *.* > + FILES will send the output of STAT both to the console and to the referenced disk file.

Output from the system debugger DDT can be saved in this way. Give the command: DDT> + DDTOUT and all output from DDT will be placed into a file called DDTOUT as it is displayed on the console. In this way, one could disassemble a program with the DDT L command and save the result on disk. Alterations could be made to the file, then it could be reassembled with ASM.

The redirection feature can be especially useful in the preparation of the users manual for an executable program. The program can be run under Microshell with the output redirected to a disk file. Then the disk file can be incorporated directly into the manual to demonstrate the operation of the program.

A variation of the redirection symbol allows new text to be appended to an existing file. A double symbol is used in this case. For example, the command: DISK >> + MANUAL will append the output from the program

DISK to the end of the existing file called MANUAL. The output is also shown on the console since the plus sign was given.

Console output can generally be sent to the printer by typing control-C prior to program execution. The same thing can be accomplished with the redirection operator. For example, the command:

DIR >+ TEMP; PIP LIST: = TEMP

will send the directory listing first to a disk file named TEMP. Then PIP is used to display the disk file on the printer. Of course, the file called TEMP is still present at the end of the task.

The previous example demonstrates the need for a UNIX construction known as a pipe. With this feature, the output from one program can be automatically directed to the input of the next. The pipe symbol is the vertical bar. In this way the previous example can be rewritten as

DIR | PIP LST: = CON:

Microshell creates the temporary file called PYPE1 for this purpose. However, it is deleted at the end of the job.

Unfortunately, the previous example introduces another problem. Sometimes, Microshell must remove line feeds, since they are automatically inserted further along the way. However, this is a case where we need to keep line feeds. Microshell incorporates a G flag, which removes (gobbles) lines feeds. It is normally turned on. We must turn it off at the beginning of this task, then turn it back on at the end. The correct command is therefore:

– G; DIR | PIP LST: = CON: ; + G

The current state of the flags can be determined by giving the – S flag.

The usual Microshell prompt is the percent sign. However, this can be changed not only to another character, but also to any combination of characters up to a length of 40. Thus it is possible to clear the screen, ring the console bell, give the current user number and disk drive, and display a statement such as ENTER COMMAND. The P flag is used to change back and forth between the simple prompt to a more complicated one.

Microshell comes with a 50-page manual that is unusually well written. It contains a table of contents, several appendices, and an index. Many useful examples are included. Because Microshell is larger than the CCP it overlays, the TPA is reduced somewhat. However, this is not likely to be a problem. Large programs that overlay the CCP can just as readily overlay Microshell. Microshell will operate correctly with most CP/M programs. However, programs that alter the BIOS or perform direct input and output will not work correctly. The manual states that MOVCPM and SUBMIT will not work with Microshell.

Some programs will operate normally under Microshell, but cannot take advantage of the new features. Microsoft Basic version 5 is one of these. For example, the command:

MBASIC >+ FILE

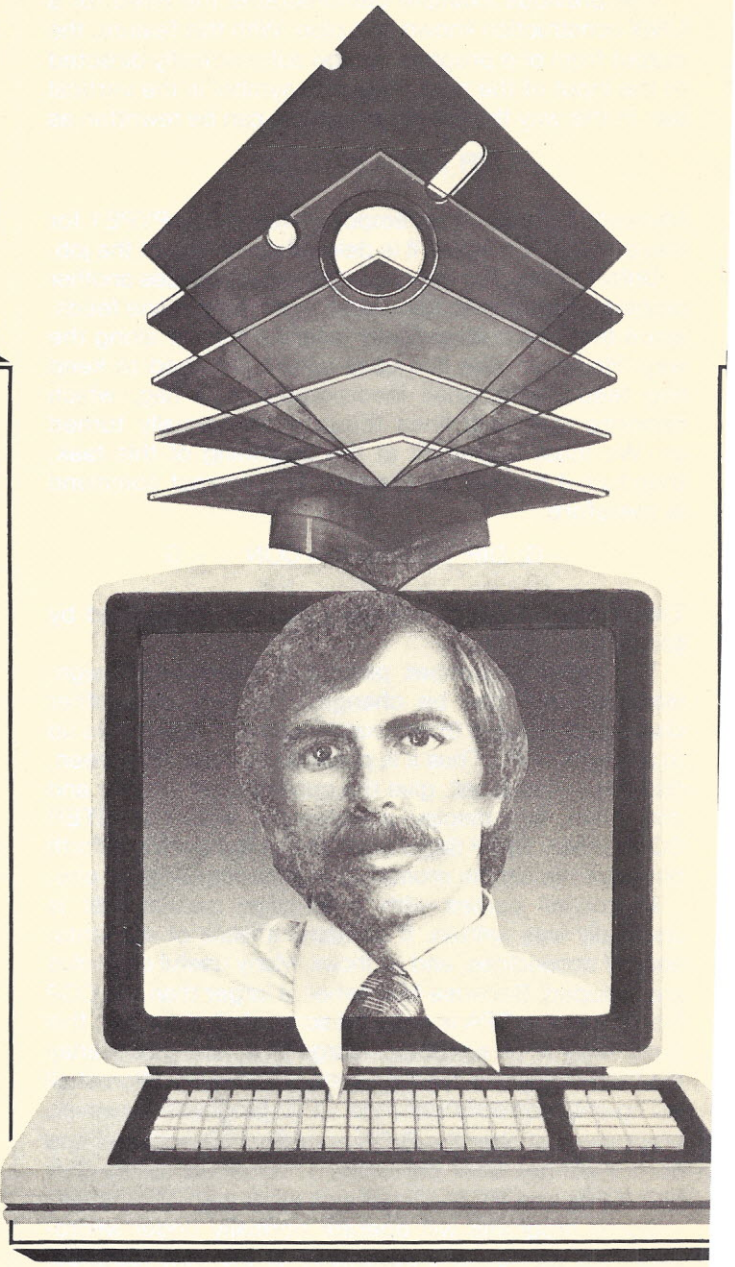
cannot be used to send console output from Basic to a disk file. Microshell incorporates its own version of SUBMIT with more features than the original. Microshell is another example of the high quality of programs currently available for CP/M.□

Software Review

SELECT A User-Oriented Word Processor

by Carl Townsend

Industry observers note a growing trend toward reducing the training time necessary to fully exploit a system's capabilities. As manufacturers seek to enhance the accessibility of software packages, a direct appeal is aimed at non-computer professionals, who prefer expedient application to experimentation or custom-program writing. As a result, more companies are shifting emphasis from traditional user manuals to on-screen self-teaching. Among the first to initiate this new breed of software was Select Information Systems (Kentfield, CA), with the introduction of its user-friendly word processing package last year. Carl Townsend's review of the Select 2.0 update represents impressions formed during the refinement of a book manuscript in an actual day-to-day working situation. ***—DWP***



Before one can fully understand word processing, it is often necessary to spend a long time learning how to manipulate a specific program. An elaborate processor with a boundless assortment of multiple-key commands and other distractions can do more to confuse the creative flow than to encourage it. As an imaginative, production-oriented writer, you might be holding out for an easy-to-use system with all the capabilities of the fancy ones.

If this is the case, you'll want to investigate Select. It was designed with the user in mind—there are no control codes, and the menu doesn't take up half the screen. It facilitates easy input. System requirements are: CP/M 1.4 or 2.2, MP/M or CDOS or IBM MSDOS, 48K bytes of memory and cursor-addressable video.

Microspace justification, proofing, subscripts, superscripts, bold print and footnote capability are standard. In the manufacturing environment where we tested Select, many people elected to use it over an expensive and full-featured word processor that they had previously used.

Select arrives on two disks. A copy of the master disk is put on the second disk unit and a new disk with PIP

Learning with Teach/M

Those businesspeople who have simple demands of their computer—such as running a word processor—are often intimidated by the CP/M operating system that is essential to many tasks.

Select Information Systems has developed Teach/M to give the unitiated user confidence in a CP/M environment. Like the tutorial module that accompanies the word processing package, Teach/M is an interactive, self-paced on-screen training program compatible with most micros. Teach/M does not attempt to cover every function of CP/M—like ASM and DDT—because these aspects are usually important only to more experienced users.

The format is quite similar to the original package reviewed in the adjoining article. The student is introduced to a CP/M function, guided through its use, then encouraged to perform a task to demonstrate understanding. After mastering a function, the student proceeds to the next—until all the selected facets of the operating system have been explained. At the end, the student is asked to participate in an exercise integrating several common office file management functions.

Like the Teach package for word processing, there is an intentional mistake built into the final scenario—Select designers apparently feel that people are inclined to learn from mistakes. Average time for successful completion is said to be 90 minutes. It works with most CP/M-based systems. Suggested retail price is $75.

and SUBMIT on the primary unit. The user then submits the install program to the master disk copy. This will copy the appropriate programs to your work disk on the primary drive, then prompt the user to insert the CAT disk received on the second disk drive. An INSTALL program on this CAT disk is brought up automatically, and this program is menu-driven.

Although this sounds complicated, the user is prompted at each step. The manual has only one page of installation documentation (as contrasted with another popular word processor that is accompanied by 41 pages of installation documentation). The terminal and printer selection menu is fairly comprehensive and is constantly being expanded. If your particular terminal is not on the menu list, contact the manufacturer for special instructions.

Once the system is installed, learning how to use it is less than painful—you'd think you were playing an adventure game. Select includes a computer-aided tutorial (CAT) that guides the first time user through the learning process in about 90 minutes.

The main menu includes a teach option, and simply pressing a T starts the tutorial. The user is instructed to put the CAT disk in the second disk drive. The tutorial then starts. A table of contents is displayed next. The user can select to learn any individual command, start at any point, or work through the entire tutorial. After each brief session, the user is generally instructed to try the command. If it is done right, the CAT gives an affirming message and offers to quit or go on to the next lesson. If a mistake is made, the CAT offers a chance to repeat the lesson.

The messages vary, and the lessons and messages are occasionally humorous to keep the sessions at a light level. We give Select high marks for developing such a pleasurable learning session. As a result, the manual is only 36 pages thick—with no sacrifice in clarity of instruction.

After the tutorial, it is easy to review any command with the H—for HELP—option of the main menu. No CAT disk needs to be used for this, and the instructions of the command are displayed on the screen.

The program uses no control codes. The system is either in a command mode waiting for a command, or in a text mode waiting for text. When in the text mode, an ESCAPE always returns the user to the command mode. When in the command mode, one or two letters executes the command and, if necessary, puts the user in a text mode.

The main menu is shown in figure 1. Each command will be displayed with a short narrative of its function. For a longer description, the user can use the HELP command.

Select has three ways of controlling the cursor. The user can use any or all of these as desired. If your terminal has cursor control keys, these can be used directly to move the cursor and is the preferred cursor control method. The second method is to use the ">" and "<" to control the prompt on the upper left of the screen. If this prompt is a ">", the space bar moves the cursor right and the carriage return moves the cursor down. If the prompt is changed to "<", the space bar moves the cursor left and the carriage return moves the cursor up. A third alternative is to use the control keys. In this case, Control/A is left, Control/D is right, Control/W is up, and Control/Z is down.

A single menu line is displayed at the top of the screen while editing. There are too many options for a single line, so the N command—for NEXT—will display the next menu line. Subsequent N commands will scroll through the menu and back to the first menu line. All commands are active, whether they are displayed or not. There are three menu lines. These editing commands are shown

in figure 2. The page, line and character position count are shown at the top of the display.

Format is altered by using the "F" command from the menu. This will display all of the current format conditions and offer the user a chance to alter any, several, or none by entering a single letter and number. This drops a command code into the text controlling the format. Codes are displayed on the screen, but are not printed unless an unformatted print is desired. While most word processors use dot commands to control format, Select uses a backward slash as the initial character for a format command. It is not necessary to use the format command to control format. With a little practice, the user will type the format commands directly into the text—bypassing the F command.

Select can proof a document by using a version of Superspell that is an integral part of the system. (See "Spelling Programs: The Proof's in the Printing" *IA* May 82.) To proof a document, simply enter an S on the main menu. The document name is entered and proofing is initialized. As proofing continues, the display will periodically indicate the number of unique words, percentage of unmatched words, and percent of prompting done at that time in the proofing.

```
CREATE - creates a new document
EDIT - edits an existing document
DELETE - deletes a document
VIEW - creates a scrolling view of the document
LIST - lists documents in directory
NAME - assigns a new name to a document
PRINT - prints a document
SPELL - proofreads a document
TEACH - teaches how to use SELECT
MERGE - merges a document with a mailing list
HELP - explains any given command
QUIT - ends a work session
RUN - runs a program outside of select
ALTER  - selects document or program development mode
```

Figure 1. Select main menu

```
INSERT - places text into document
ERASE - erases portions of the text
POINTER - sets pointer to control command range
GOTO - moves cursor to a pointer or page
LOCATE - search command for characters, words or phrases
REPLACE - changes characters, words or phrases
DISPLAY - shows next screen (forward or backward)
QUIT - ends editing work
NEXT - scrolls to next menu line
FORMAT - sets format values for document
SPELL - enters a proofreading mode
APPEND - adds a disk document to the displayed document
VERIFY - re-displays screen
XCHNG - exchanges letters or words
TAB - sets tabs
HELP - displays instructions for a command
MOVE - transports text from one part of document to another
COPY - duplicates a block of text to another part of document
ZAP - kills a portion of the text
OUTPUT - prints out a block of the text
WRITE - saves a portion of the text in a file
JUSTIFY - evens the margins a a text
```

Figure 2. Editing menu

After the proof completion, Superspell enters Word Review mode. Each mismatched word is displayed and the user given the option of marking it for correction, adding it to the dictionary or ignoring the word. Marked words are scanned and the user can correct each in turn or skip the word. Superspell includes commands to list the dictionary, combine dictionaries, subtract or copy dictionaries. For many purposes, it is advisable to keep program disks for each application. In this way, the dictionaries on the disk reflect the words used in that particular application.

Select includes a mailmerge option that permits driving a template letter from an address file. Addresses and greetings can be dropped into the letter automatically from address files prepared with conventional mailing list programs as NAD. Names and one reference field can be dropped into the letter. The current mailmerge is a little limited compared to other word processors, but is more than adequate for most users. This feature will probably be expanded in later releases.

When Select is brought up in document mode, the automatic wrap-around is on, the text is left-justified and the margins are 10 and 75. If switched to the program mode, margins are 1 and 80 with word-wrap off and no justification. If the margins are changed within the text, moving the cursor will cause the ruler at the top of the screen to always show the margins at the given point in the text.

No disk banging

Disk buffering is excellent. Select does little disk banging—normally a time when systems lose needed text buffering. Thus eyes can be kept on the text and typing continued without a disk-write every few pages. In an MP/M system with several users, each will probably be unaware of the other users. Intermediate writes can be forced if the user desires. Select is also clean if a disk becomes full. It will stop, give a message about what happened, and allow the user to select a disk unit for another disk. Original and backup copies of the document file are then transferred to the new disk automatically.

The tabbing facility could be improved. Positions are only variable up to 80 columns. Common financial reports of 132 columns cannot be tabbed. Also, it is not possible to save the tab positions. The text is saved, but to add or edit, the tabs need to be set again. Future enhancements are planned for this feature.

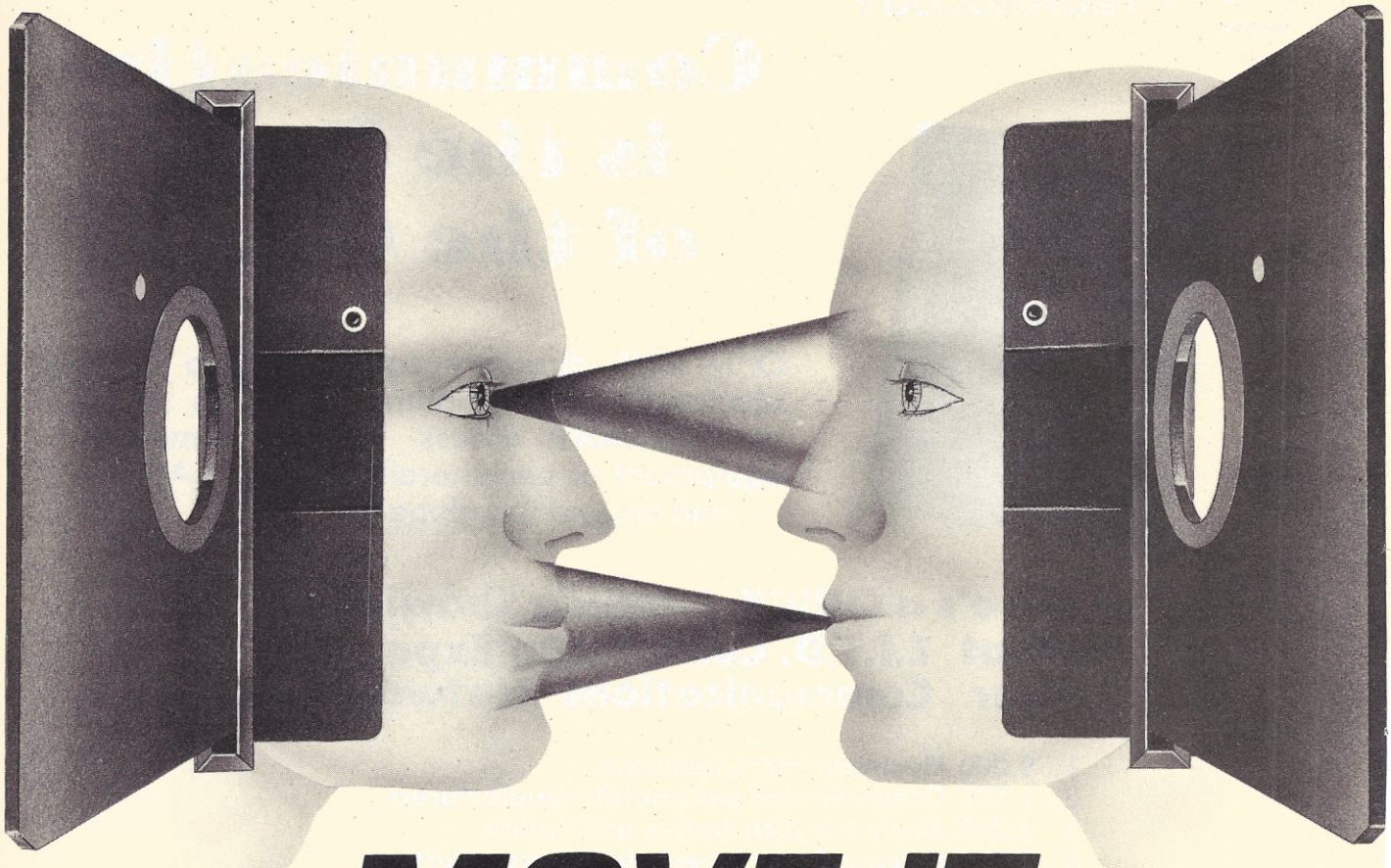
Justifying occurs automatically on exiting the insert or erase commands. It can be done at any time using the Justify command. The justified text can be viewed on the screen before saving. The justifying is a little time consuming, and this can be aggravating when editing. A toggle is included to turn off the justification until editing is completed.

Printing was easy, without a lot of questions and dialogue before starting. Options exist for many things, but the user can bypass these options if they are unnecessary. There are currently no commands for creating a table of contents or indexing.

Select cannot distinguish between hard and soft spaces. A hard space is one inserted by the user. A soft space is one generated by the system—as in justification. User-generated spaces can be lost. As an example, a secretary would want two spaces between every period and the first letter of the next sentence. Upon justification, some of these two spaces might become one space. This doesn't happen frequently, but it can occur.

Underlining, bold print, subscripts and superscripts are controlled by embedded characters—not by control codes. These characters are the caret marks, underscore and brackets. If you use these characters as text, they must be preceded by a backslash. Hidden messages can also be embedded in the text that won't print.

Select emerges as an honorable offering amidst a crowded field. Its simplicity can be an asset. It is probably the best available word processor for program development and text processing that does not require camera-ready copy for output. Manufacturer support is excellent. It is priced just under $600.□



MOVE-IT
Inter-Computer Communication System

by Rocky Smolin

The Move-It program (Woolf Software Systems, Canoga Park, CA) allows one to send and obtain files from another computer running the same program. Since it runs under the CP/M or MP/M operating systems, it is comparatively hardware-independent. As disk formats —particularly those of 5¼-in. diskettes—are not entirely standardized, this program will be of particular interest to software vendors who need to distribute on 5¼-in. media. (Most CP/M- and MP/M-based machines will now read single density, 8-in. IBM format diskettes.)

Since it will work effectively over modems, it can be used to download software and files, as well as send for files from a central data base. As local and remote networking of micros becomes more prevalent, easy-to-use utility communications software will become more and more desirable.

Move-It uses a packet format, which includes message number, data count and 16-bit checksumming. This results in a very low error rate—the most important factor in computer communications.

For this review, we set up the serial ports on two Radio Shack model IIs through the CP/M operating system, and the connection of same with a homemade cable. The comprehensive user's manual, which makes up in clarity whatever it may lack in beauty, answered all our questions as they arose. Since most micro software requires minor customization to work with a particular machine—and this must be done before the programs can be run—it's incomprehensible why the setup data

is generally found towards the end of the manual rather than in the first chapter. Move-It is no exception.

Other systems accessible by Move-It include Eagle II, Vector, Northstar, Heath/Zenith, Processor Technology, Xerox, Tarbell, Altair, Imsai, Cromemco and the D.C. Hayes Micromodem 100. Judging from manufacturer Jeff Woolf's solicitous phone calls, we expect that if your machine is not listed here, he would be glad to dig up the right values and supply them for you.

The commands are few, but powerful, with some nice features

To run the program, all you have to do is type MOVE-IT. An asterisk in column 1 indicates that the program is operating and ready to accept a command. Of course, both computers must be running Move-It for communication to take place. The commands are few, but powerful, with some nice features.

The following command is used to send a file to the remote computer: SEND—SEND DRIVE:FILENAME.TYP (AS DRIVE:FILENAME.TYP). All the usual CP/M wildcard formats are legal (such as *.BAS for all Basic files). Normally the file is received on the remote computer as the same name but the use of the optional AS parameter will deliver it with any name you like. When transmission starts, a message (''SENDING Filename...'') appears on the screen. Move-It will print COMPLETE when it finishes. Transmission is not too fast—most of the time is taken up in disk operations.

To request a file from the remote computer, enter: GET —GET DRIVE:FILENAME.TYP (AS DRIVE:FILENAME.TYP). File specifications are the same as with SEND. In both SEND and GET, the drive specification in the AS clause can be used to direct the file to a specific drive.

Commanding NOCONSOLE prevents Move-It from echoing prompts and other messages to the user's console. This is useful under MP/M because the communication line is used both as the console and the data line. If the console is assigned to the modem port, and an auto-answer modem is used, Move-It could then be used to allow full unattended remote access to the computer system.

The following commands are also primary features:

ASCII allows Move-It to send and receive messages in ASCII format (useful if your machine has less than the normal 8 bit data path to transfer files).

BINARY is the opposite of ASCII, facilitating transmission in 8-bit format.

LDIR is for listing the directory; uses all the same formats as the regular CP/M DIR commands.

RDIR gets the directory from the remote computer; same format as above. This is an important feature.

MESSAGE allows the user to send a message to the remote computer such as ''CHANGE TO NEXT DISK.''

TRIES displays the number of retries that the program has done during the transmitting and receiving of files since the last time it was reset.

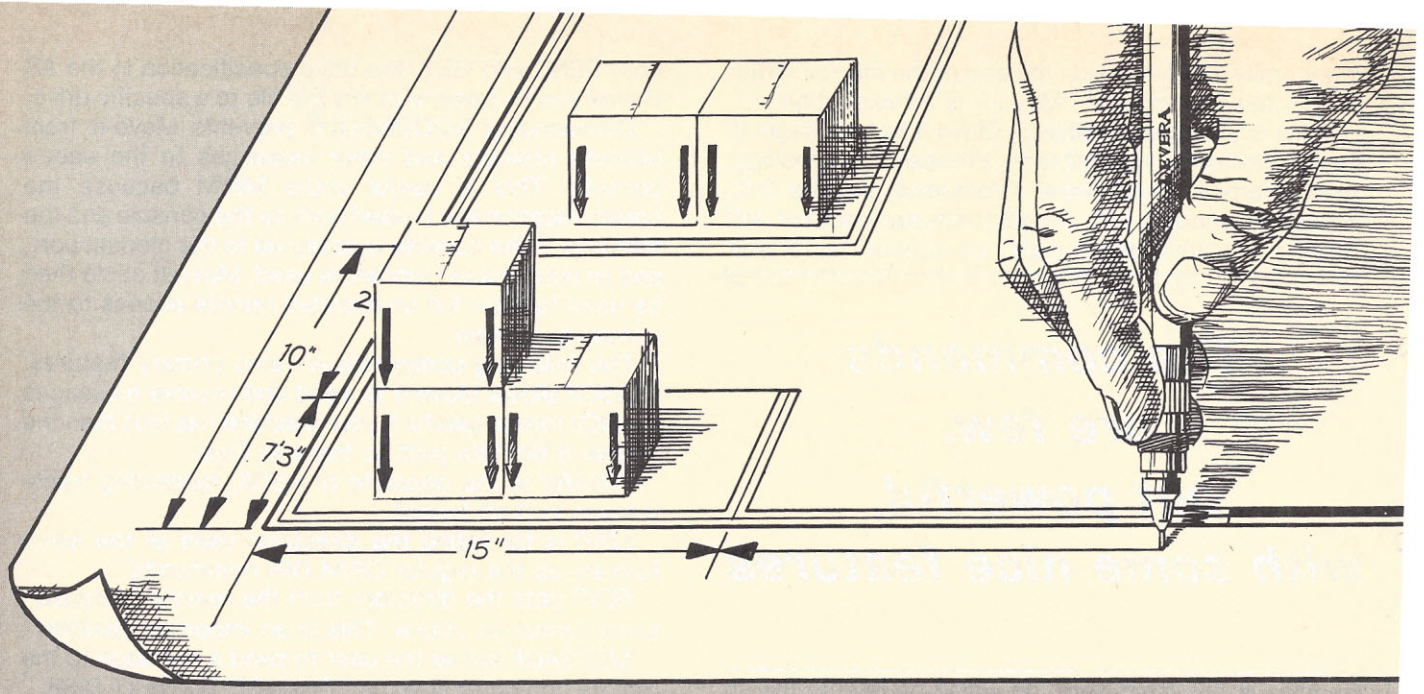
TALK turns your computer into a dumb terminal sending out the communications port any characters entered through the keyboard. It can be used to talk to databases like The Source, log into a timesharing system or converse with another Move-It in the same mode.

EXIT returns to CP/M.

Move-It will display descriptive error messages if necessary. For example: 'File name already exists. Replace?'; 'Remote directory full'; 'Directory full'; 'Remote disk full'; 'Disk full' or 'Communications line failure'.

The installation guide contains a description and diagram of the pin connections for a cable, a step-by-step how-to-set-it-up, and how to write a custom MOVE-BIOS. Woolf will also write one specifically for you if necessary.

Move-It is a straightforward, no-frills utility. If you are seeking communications software, definitely take a look at this one. It is one of the few packages that actually works as advertised. Retail price is $99.95.□



Solving Plant/Warehouse Location Problems

by F. Robert Jacobs, Ph.D.

In warehouse location problems, the primary concern is to meet the needs of customers at the lowest possible cost. For a manufacturing firm distributing products throughout the U.S., strategically-positioned warehouses are crucial. The accompanying program will aid a company in determining *how many* warehouses there should be and *where* they should be located.

Many factors need to be considered in warehouse planning. These variables can be categorized as either tangible or intangible. For example, the cost of transporting products to customers can be estimated if one has access to enough information. It is possible to quantify and is thus tangible. The desirability of a city to which employees would be transferred if a new warehouse were opened may be difficult to quantify and is therefore an intangible factor.

We are concerned here with a technique allowing tangible factors to be considered in solving these problems. Intangible factors can be thought of as defining the feasibility of potential candidate locations for either plants or warehouses. Given a set of feasible locations—those that are acceptable from the standpoint of intangible factors—the subset of locations that can best serve customers by consideration of tangible factors can be found.

Consider the following example. A firm is considering establishing some warehouses to reduce distribution costs and time delays in distributing products from a central point to four primary markets.

The accompanying table reflects fixed annual operating costs and total transportation costs for supplying a customer region entirely from a given warehouse. Which warehouses should be established?

In this problem, assume that the potential warehouse sites in St. Louis, Memphis and Jacksonville are considered feasible based on intangible criteria. To formulate a solution, minimizing total fixed operating and transportation costs are of primary concern.

Comparison of location cost factors

POTENTIAL WAREHOUSES	FIXED COSTS	CUSTOMER REGION A	B	C	D
St. Louis	$50,000	$ 75,000	$50,000	$55,000	$20,000
Memphis	$45,000	$ 80,000	$45,000	$60,000	$30,000
Jacksonville	$48,000	$100,000	$35,000	$70,000	$40,000

In order to further delineate the problem, let's examine two possible solutions. One alternative might be to maintain a single warehouse serving all customers. Since Memphis has the lowest fixed cost, consider the implications of opening it and closing the St. Louis and Jacksonville warehouses. The cost associated with this solution would be the sum of the fixed and transportation costs for the Memphis warehouse:

$$\text{Total Cost} = 45{,}000 + 80{,}000 + 45{,}000 + 60{,}000 + 30{,}000 = \$260{,}000.$$

It's difficult at this point to evaluate how good this solution is, but at least we have a solution for comparison purposes.

A second solution might be opening two warehouses. Since Memphis and Jacksonville have the lowest fixed costs, consider opening them and closing the St. Louis warehouse. Evaluating this solution is a little more difficult. Assuming each customer will be served by a single warehouse, the total cost can be found as follows:

$$\text{Total Cost} = 45{,}000 + 48{,}000 + 80{,}000 + 35{,}000 + 60{,}000 + 30{,}000 = \$298{,}000.$$

Notice that in the solution, each customer is served by the warehouse that is open and has the lowest transportation cost.

Obviously, this solution is not as good as the preceding one. All possible solutions could be evaluated, but the problems can get complex very quickly.

A useful procedure has been developed by B.M. Khumawala (*Naval Research Logistics Quarterly*, Mar 73) for solving such a problem. It can be easily implemented on a small computer. Although the procedure does not guarantee that the "best" solution will be found, it has been found to work very well on large, real-world problems.

The technique works as follows:

Step 1—Calculate the minimum savings that could be achieved by opening any single warehouse. If this minimum savings is greater than zero, automatically fix that warehouse open. In the case that all minimum savings are negative, open the warehouse whose savings is the closest to zero.

For our example, the following minimum savings calculations are made:

$$\text{MINSAV(St.Louis)} = (5{,}000 + 0 + 5{,}000 + 10{,}000) - 50{,}000 = -\$30{,}000$$

If St. Louis is opened, $5,000 is saved over the next best alternative for serving customer A(Memphis). There are no savings for customer B, $5,000 for customer C and $10,000 for customer D. The fixed cost associated with operating the St. Louis warehouse is $50,000. Continuing for the other warehouses:

$$\text{MINSAV(Memphis)} = (0 + 0 + 0 + 0) - 45{,}000 = -\$45{,}000$$

$$\text{MINSAV(Jacksonville)} = (0 + 10{,}000 + 0 + 0) - 48{,}000 = -\$38{,}000$$

Since St. Louis has the largest MINSAV value, open it. Notice that in this example, none of the savings were greater than zero.

Step 2—Next calculate the maximum savings for those warehouses that have been neither open nor closed. We refer to these warehouses as "free." The maximum savings is calculated by comparing the distribution costs of the free warehouse with those of the ones that have been fixed open. Other warehouses that are free or fixed closed are ignored. Open the warehouse with the largest positive maximum savings (if any exist). Similarly, fix closed any warehouses whose maximum savings is negative. Step 2 is repeated until a decision is reached on each potential warehouse location.

For our example, the step 2 calculations proceed as follows, given that the St. Louis warehouse is open:

$$\text{MAXSAV(Memphis)} = (0 + 5{,}000 + 0 + 0) - 45{,}000 = -\$40{,}000$$

$$\text{MAXSAV(Jacksonville)} = (0 + 15{,}000 + 0 + 0) - 48{,}000 = -\$33{,}000$$

Since both remaining warehouses have maximum savings less than zero, both are closed, and the best solution is to open only the St. Louis warehouse. This solution has an annual cost of (50,000 + 75,000 + 50,000 + 55,000 + 20,000) = $250,000.

The accompanying program is written in MBasic. It uses no files or other system-dependent features, and should therefore be easily implemented on any system that can run Basic. The only limitation is the amount of available memory. Problems with up to 50 potential warehouses and 75 customers can be solved on a 64K-byte system. □

Program on page 156

1982 NCC Highlights

About the time this issue reaches *IA* readers, the 1982 National Computer Conference (June 7-10) will be underway at the Astrodomain in Houston, TX. More than 650 exhibitors will be spotlighting their computer services and products to over 60,000 computer professionals from all over the U.S.—and abroad.

The NCC is one of the primary forums for U.S. computer merchandisers to demonstrate their wares. The annual event is sponsored by the American Federation of Information Processing Societies (AFIPS, Arlington, VA).

Besides product demonstrations, a valuable part of the NCC is traditionally the Professional Development Seminar series. This year's sessions include 17 seminars—13 full-day courses and four half-day courses. The seminars are divided into five categories: Computer Graphics, Communications/Data Security, Data Management, Current Issues in New Technology, and General.

A sample list of the seminars and instructors includes: "Computer Graphics Design for Effective Communication" by George F. McLeary, Jr. (University of Kansas); "Overview and Directions in Local Computer Networks" by Harvey A. Freeman (Architecture Technology Corp.); "Data Base Management in the 80s" by James A. Larson (Honeywell); "Low Cost Word Processing" by Dr. Laurence Press (Small Systems Group); and "Motivating Data Processing Personnel" by Dr. J. Daniel Couger (University of Colorado).

The seminars are all held at the Shamrock Hilton Hotel. For those unable to attend, copies of NCC proceedings and cassettes of individual sessions are available through AFIPS (1815 N. Lynn St., Arlington, VA 22209).

Guest speakers will offer timely and topical discussions of issues vital to the information processing community. Speakers include James E. Olson, Vice-Chairman of the Board of AT&T and Theodore A. Burtis, Chief Executive Officer of Sun Co.

Special events include Pioneer Day, Wednesday, June 9, which will review the 25-year history of computing from the introduction of the Fortran compiler in 1957. Such computing pioneers as J. Presper Eckert, Jr., Maurice Wilkes, Herman H. Goldstine and Richard Clippinger will be on hand. Included will be a special exhibit, financed by IBM, displaying historical manuals and memorablia of the early days of computing.

A career-planning workshop, conducted by Herbert B. Safford, CDP, and GTE Data Services and a film forum—covering topics from DP management to robotics—are among other noteworthy items at the show.

This month, we have devoted our entire New Products section to NCC product announcements. The products that follow represent only a few of the hundreds of hardware and software offerings on display at this year's show.

Intelligent voice terminal, VRT101, combines 100-word vocabulary, the CP/M operating system and a broad range of disk storage options. It can be installed without modification to existing application software. Interstate Electronics, Anaheim, CA.
CIRCLE INQUIRY NO. 201

Data communications/electronic mail software, Transend 3, runs on the Apple II. Support capabilities include 80-column video boards, 1200 baud modems, and hard

disks. Software features include verified file transfer and data compression/decompression. The Private Mail feature allows for complete data privacy. The Mailbox option allows creation and addressing of Private Mail diskettes. The program can automatically transmit information to as many as 100 Apples and 10,000 addresses. SSM Microcomputer Products, San Jose, CA.
CIRCLE INQUIRY NO. 202

Microcomputer systems, 500 series, are designed as stand-alone business computers or as user stations in the Billings Distributed Processing Network. Available with configurations of 5¼-in. minifloppies or 8-in. floppies, online mass storage capacity is up to 4M bytes. It features a detachable keyboard with 16 function keys, a numeric pad, eight cursor control keys and a standard typewriter section for a total of 94 keys. The CRT is high-contrast green and di-electric coated. Billings Corp., Independence, MO.
CIRCLE INQUIRY NO. 203

Operating system for 8086- or 8088-based microcomputers, Concurrent CP/M-86, permits a single user to perform multiple jobs. The product is compatible with CP/M-86 and MP/M-86. Concurrent CP/M-86 offers file-structure compatibility with all Digital Research operating systems. It supports up to 16 logical drives, each containing up to 512M bytes, for a maximum of four gigabytes of on-line storage. Other features include a real-time kernel, record- and file-locking, date and time stamps, password protection on files, error-handling and reporting, network compatibility and multiprogramming capability. Digital Research, Pacific Grove, CA.
CIRCLE INQUIRY NO. 204

Acoustical enclosure, Quietizer 2211, for the Diablo 630 RO printer requires no machine modifications. Units are made of steel and air flow is maintained by an internally mounted fan. Van San Corp., City of Industry, CA.
CIRCLE INQUIRY NO. 208

BLIS/COBOL operating system, version 5.0, supports up to 2M bytes of main memory. BLIS/COBOL is a multiuser on-line operating system for Data General, Point 4, Ampex, Bytronix, Digidyne, Ardent, and other Nova-compatible computers. One to 30 users can each run up to 200K-byte Cobol programs without any modification on CPUs using either 16-bit extended

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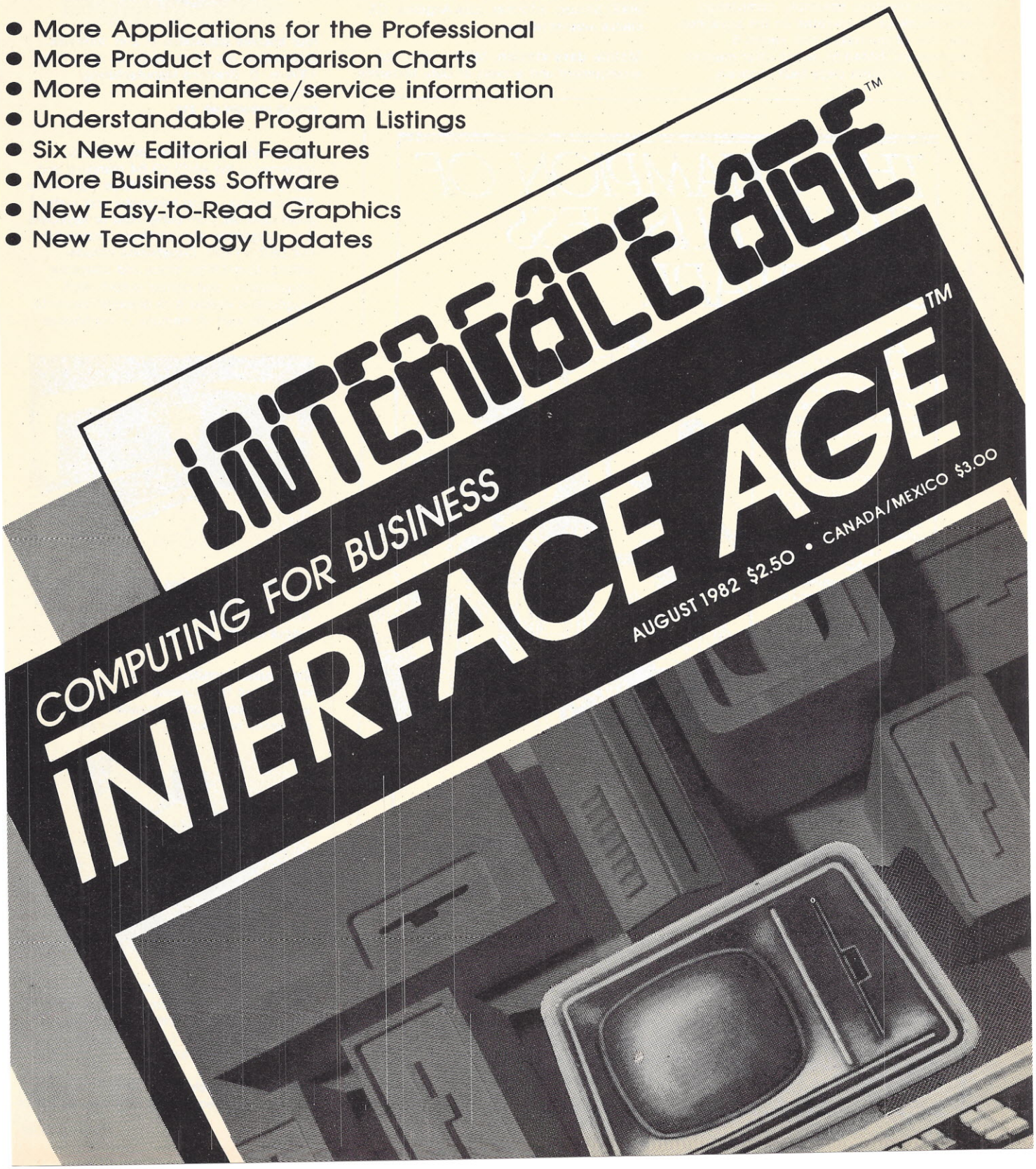


memory addressing (128K-byte) or up to 2M bytes of mapped memory. Other enhancements of version 5.0 are 2K-byte screen records, programmable CRT function keys support, CRT block mode transfers, numerous cursor control features, and alternate sector support. Information Processing, Winter Park, FL.
CIRCLE INQUIRY NO. 210

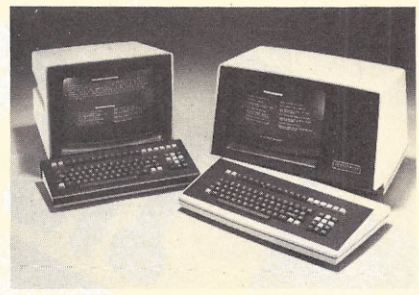
Real-time operating system, Cartos, is a multi-user/multi-tasking real-time operating system that permits real-time operation to proceed in parallel with program creation, assembly, compilation and checkout. It operates on the advanced features of the naked mini series 5 processors (NM4/85), which offer memory mapping, efficient page fault recovery, memory protection, memory error correction and optional cache. Computer Automation, Irvine, CA.
CIRCLE INQUIRY NO. 211

Cluster controller, 209, includes a 25th status line, a choice of green or white phosphor screen and interface capability with any ASCII printer. A daisy chain interface allows terminals to be connected in multi-drop. It is designed to communicate with IBM communications processors via multipoint Binary Synchronous Communications protocol through standard synchronous modems at speeds of up to 9600 bit/sec. Informer, Los Angeles, CA.
CIRCLE INQUIRY NO. 214

Mobile data station, MDS-1, provides arrangement and access of Data Materials suitable for computer print-out forms, floppy disk tubs or ring binders. Features

four shelves adjustable at 2-in. intervals. Dimensions are 18-in. W by 31½-in. H by 13½-in. D. Bretford Manufacturing, Schiller Park, IL.
CIRCLE INQUIRY NO. 212

Alphanumeric CRT terminal, Guru, implements the ANSI X3.64 standard and can display from 18 to 60 lines from 40 to 160 columns, using horizontal and vertical zoom controls from either host or keyboard. It is compatible with software written for the DEC VT100. Capabilities include editing, form-filling, block and character transmission, and printer output. Self-diagnostics enable it to pinpoint failure to a specific part of memory. A continuous



test feature facilitates troubleshooting on intermittent failures. Ann Arbor Terminals, Ann Arbor, MI.
CIRCLE INQUIRY NO. 213

Computer furniture, Data Leggett, is engineered to decrease head, hand and eye movements and increase operator efficiency and comfort. It features

positioning of source documents between keyboard and video screen, adjustability of the video platform and compact size. Conmark Graphics, La Canada, CA.
CIRCLE INQUIRY NO. 205

Adjustable desk tops, User Friendly Office, for video display terminals adjust to

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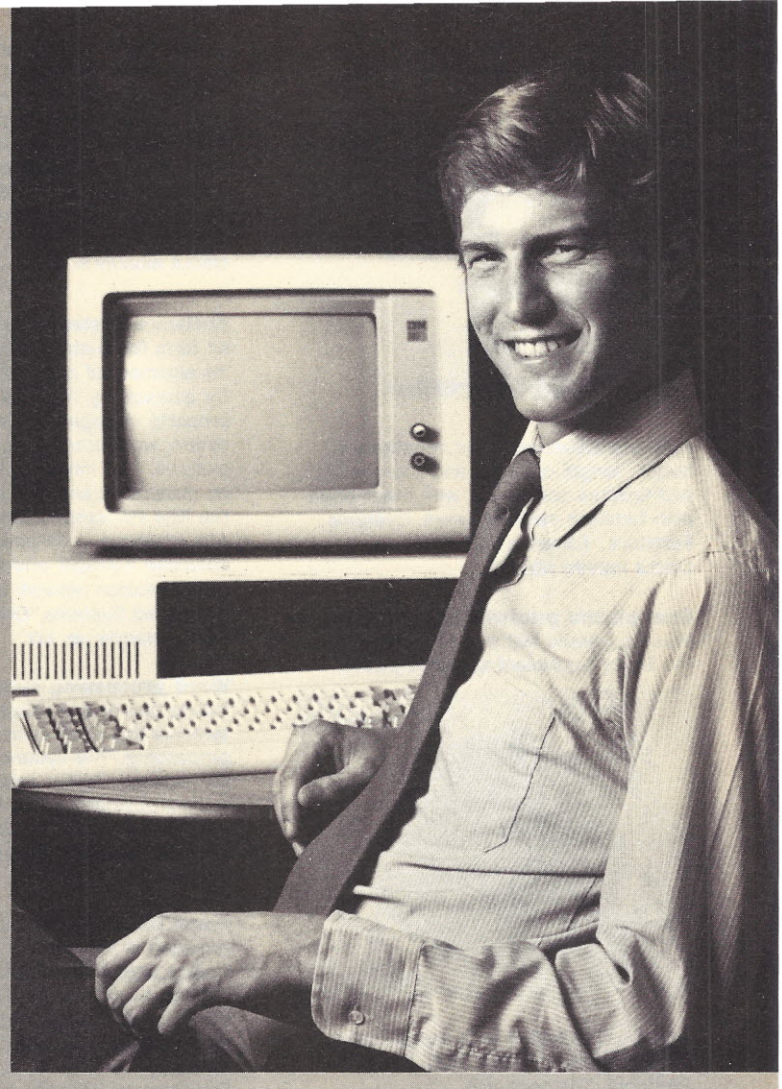

A new generation word processor designed to satisfy the demanding needs of a growing business. This totally new product is powerful, yet easy to learn and use.

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State-of-the-art spell checking. With the largest dictionary in micros - 88,710 words in only 94k disk space. It can check any file stored in the IBM DOS format.

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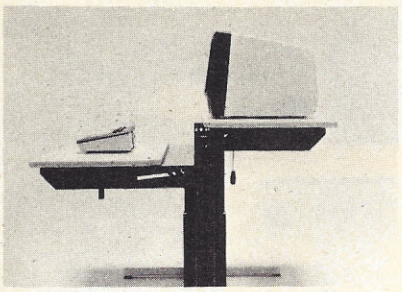
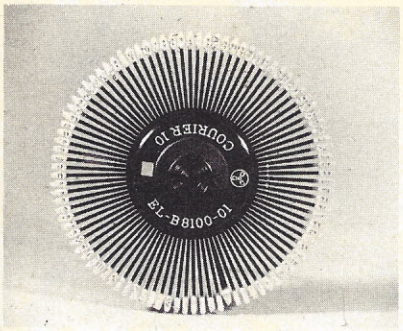
CIRCLE INQUIRY NO. 51

comfort level of terminal users. They feature minimum surface glare, six



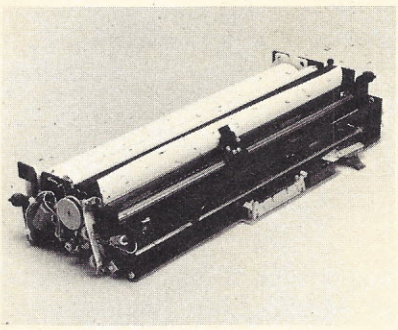
separate adjustments for variations in height, length of reach and line-of-sight, and finishes compatible with other open plan furniture manufacturers. Systems Furniture, Torrance, CA.
CIRCLE INQUIRY NO. 206

Dual plastic printwheels, Extended Life Wheels, should last five to eight times the life of equivalent standard plastic



wheels. Compatible with Qume, Diablo, Dataproducts and IBM. AGT Computer Products, Torrance, CA.
CIRCLE INQUIRY NO. 207

Lightweight microprocessor-based printer, Execuport P200, produces bi-directional copy with 120 character-per-second throughput. It has a unique 16-element columnar printhead and is equipped with two standard character



fonts: 9-in. by 11-in. and 5-in. by 7-in. It is equipped with a standard Centronics-compatible interface (8-bit TTL). Bi-directional communication with control and status lines is also supported. Computer Transceiver Systems, Paramus, NJ.
CIRCLE INQUIRY NO. 215

Multi-user operation and business software, Oasis-16, is now available to IBM Personal Computer users. It simultaneously coordinates up to three users and up to 32 users with appropriate bus expansion. Private, shared or public files, optional passwords and privilege level security provide data protection in multi-user activities. Minimum configuration for the IBM/OASIS system requires 128K-bytes RAM, monochrome display adapter, 5¼-in. floppy disk adapter with two drives, and a 5M-byte hard disk. Phase One Systems, Oakland, CA.
CIRCLE INQUIRY NO. 216

Software system, TIS-APL, is available in kit form for custom applications and development of comprehensive applications for accounting, financial management, property management, network communication, work-processing and statistical analysis. The integrated system is available on many 8-bit and 16-bit micros including the IBM Personal Computer. It offers the APL langauge, a dynamic operating system, database manager and file handler and communication network builder. Telecompute Integrated Systems, Ontario, Canada.
CIRCLE INQUIRY NO. 217

Word processing system, Wordmate, makes use of a multipurpose computer terminal that does both word and data processing. The system operates on Microdata's Reality computer series and Sequel business system. It uses mnemonic commands and many other advanced features. Microdata Corp., Irvine, CA.
CIRCLE INQUIRY NO. 218

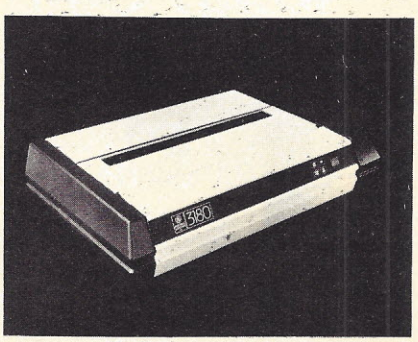
Small business system, series 8000, provides multiple users with capabilities for instant update and retrieval of information stored in on-line data files. It offers MOS memory technology and Winchester-type mass storage disk units. MOS memory expansion is offered up to 512K bytes. Disk storage capacity is up to 514M bytes. Multiple interactive terminals support a maximum of 40 on-line users. Microdata, Irvine, CA.
CIRCLE INQUIRY NO. 219

16-bit computer system, series 550, in its basic configuration comprises 600nS central processor, using Data General-compatible instruction set and byte-handling extended instructions, 64K bytes of memory, a disk controller capable of driving up to two Control Data Lark 16M-byte drives, a printer controller, a secondary RS-232 port, packaged within a 1920-character video display unit with

keyboard. The new series offers memory expansion to 128K bytes, plus the addition of an external, rack-mountable, 7-in. panel providing four full-duplex multiplexer channels, operating at selectable baud rates from 110 to 9600. It runs under several commercially-available multi-user operating systems, such as IRIS, IOS, BITS, BLIS/Cobol. Bytronix Corp., Fullerton, CA.
CIRCLE INQUIRY NO. 220

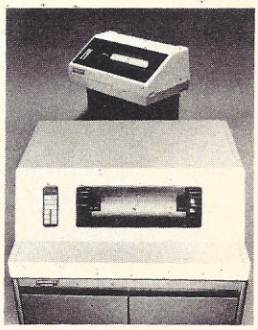
Software generator, All Application Language Liberator, does not use conventional programming language or coding to develop business applications. The package reduces development, testing and debugging time and eliminates the need for documentation. It is self-documenting—upon completion of the application, operator's instructions and application specifications are printed out. Microdata, Irvine, CA.
CIRCLE INQUIRY NO. 221

Serial matrix printers, GE 3000 series, offer data processing, word processing, and graphics modes of operation. The line performs data processing tasks at print speeds up to 600 characters per second. Two models offer a high-resolution print mode, which provides overlapping dots for near-letter quality printing at 120 to 198



characters per second, depending upon character pitch. A dot-addressable graphics capability is another feature. Print speeds, line spacing, paper slew rate, and other performance parameters vary from model to model. Each model employs a logic-seeking printhead to bidirectionally print up to six copies. General Electric, Waynesboro, VA.
CIRCLE INQUIRY NO. 222

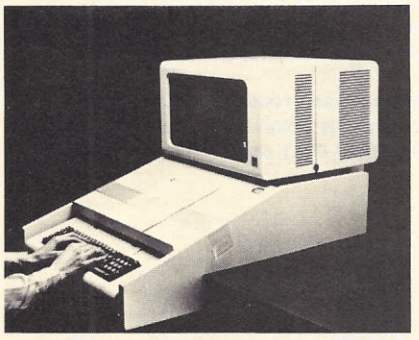
600 LPM band printer subsystem, LP series, is plug-compatible with many DEC, Data General and IBM systems. These printers are available in two versions: a standard pedestal-mounted unit with open paper path and a totally enclosed version to provide office environments with a noise



level less than 60 dbA. Both models feature an operator activated self-test capability. There is a choice of 48, 64, 96 and 128 character set print bands. Print-out specifications include a 132-column print line with 10 character/inch horizontal

spacing and 6 or 8 line per inch vertical spacing. Centronics, Hudson, NH.
CIRCLE INQUIRY NO. 223

Ergonomic work stations, Input-Ez, are designed to ensure that the keyboard and video screen are at the proper height and distance from the operator, and that input

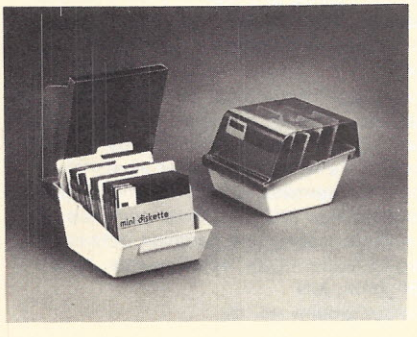


documents reside directly between the keyboard and screen, allowing single-axis vertical eye movement from data sheets to the screen. Input-Ez Corp., Englewood, CO.
CIRCLE INQUIRY NO. 224

Voice recognition terminal, VRT101, performs voice controlled data and word processing with a vocabulary of up to 100 words at a time. It is a fully-integrated voice

recognition system for users who wish to abstain from involvement in software or electronics design or interface. Interstate Electronics Corp., Anaheim, CA.
CIRCLE INQUIRY NO. 225

Diskette trays, 050 series, are available for either 5¼-in. or 8-in. floppies and come with rigid plastic dividers. Foam

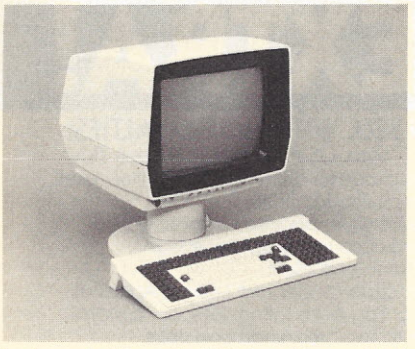


cushion bottom contacts diskettes at the corners to protect read/write area. Ring King Visibles, Inc., Muscatine, IA.
CIRCLE INQUIRY NO. 226

Proprietary software system, Business Express, generates user application solutions directly from menu-driven prompts, bypassing the use of high level

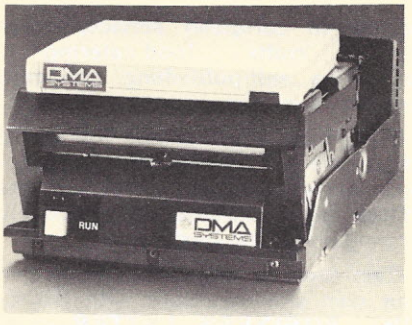
languages. It is a complete business application system for the System 2800 computer family consisting of an integrated database manager, word processor and multi-user operating system. It employs features of both relational and hierarchical database structures. The standard system supports 10 simultaneous users with a maximum of 24 terminals available. Systems Group, Orange, CA.
CIRCLE INQUIRY NO. 227

Terminal system, series 8000, can be clustered with up to 32 terminals. Height, tilt, swivel and the keyboard angle are adjustable. A flat detached programmable



keyboard with up to 155 keys is provided. Both the terminals and controller are designed with the 16-bit 68000 microprocessor. Megadata Corp., Bohemia, NY.
CIRCLE INQUIRY NO. 228

Removable 5¼-in. Winchester disk drive, Micro-Magnum 5, using the proposed ANSI-standard disk cartridge, employs the same basic technology as the



company's Micro-Magnum 5/5 fixed/removable 5.25-in. Winchester. The Micro-Magnum 5 may be used as backup for 5.25-in fixed disk Winchesters, as an I/O device. DMA Systems, Santa Barbara, CA.
CIRCLE INQUIRY NO. 229

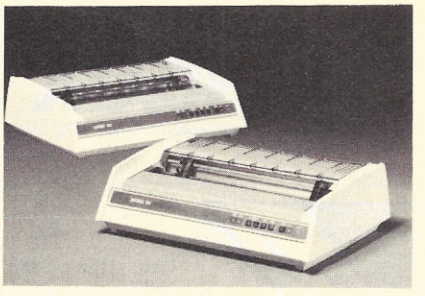
Winchester hard disk drives (both 5¼- and 8-in.) with floppy disk backup are available for micros. The 5¼-in. combination uses a 5M-byte hard disk and 1M-byte floppy. The 8-in. system has 10M-byte on the hard disk and 1.6M-byte on the floppy. Trak Microcomputer Corp., Downers Grove, IL.
CIRCLE INQUIRY NO. 230

Dual mode printer, WP-6000, operates in either of two modes—correspondence quality at 150 cps or data processing at speeds up to 500 cps. It can change fonts electronically. Character fonts are stored in ROM within the printer, and special characters, Greek symbols and mathematical symbols may be called up under software control. Anadex, Chatsworth, CA.
CIRCLE INQUIRY NO. 232

Programmable video display terminal, Swid, features DEC VT-100 compatibility with ANSI 3.64 interface, English language

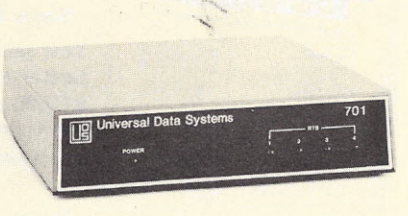
setup, split screen display and scrolling, 12 programmable function keys, simulated block mode transmission, and RS-232C interface. General Terminal, Tustin, CA.
CIRCLE INQUIRY NO. 231

Functional printers, 900 series, fit data processing, business graphics and corre-



spondence print needs. The model 910 operates at 200 cps and the model 920 at 340 cps. Printek, Benton Harbor, MI.
CIRCLE INQUIRY NO. 233

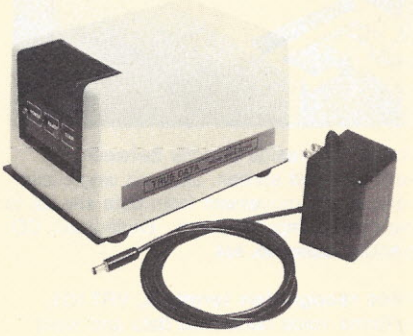
Modem sharing device, model 701, provides four RS-232C ports for connecting external peripheral devices allowing for asynchronous or synchronous devices up to 9600 bps to operate in conjunction with one modem and the central site. It permits a wide variety of multi-drop configurations. Front panel LED indicators monitor the separate channels with respect to the RTS control signal and the power supply status.



Internal data buffering permits separate terminal and modem clocks. Universal Data Systems, Huntsville, AL.
CIRCLE INQUIRY NO. 234

Topical antistat, EDP Staticide, is designed to eliminate static-induced problems in computers and other electronic equipment. It meets the static-decay criteria of military and medical specifications and is effective at relative humidities below 15%. It will also prevent dust attraction to surfaces. It is non-toxic, non-flammable, biodegradable and leaves no residue. ACL, Inc., Elk Grove Village, IL.
CIRCLE INQUIRY NO. 235

Optical card readers, Micro Mark series, are low-cost, high speed data and program statement entry peripherals for the



educational or personal users. The units accept and read both marked (number two pencil) and punched cards. True Data Corp., Irvine, CA.
CIRCLE INQUIRY NO. 236

Disk drive, Atlas, is a 14-in. multi-platter device that provides storage in the 80-100M-byte range. The use of multiple heads and advanced head-positioning techniques allow average seek times of under 17 mS. Data may be accessed in continuous 1M-byte sections due to the logical cylinders being organized in 1M-byte increments. The product is SMD- and ANSI-compatible. This machine employs three hard-metal plated disks and light-weight and non-contact flying heads. Package design is standard 19-in. rack, 7-in. high and 24-in. deep. Alpha Data, Chatsworth, CA.
CIRCLE INQUIRY NO. 237

Pocket-sized interface test set, Multi-Tech MT25, provides individual access to all EIA-RS232 and CCITT-V.24 interface signals. When connected on-line between a data modem and data terminal or computer, 13 LED indicators monitor line conditions of the most commonly used EIA signals, while 24 miniature switches allow any signal to be interrupted. Test access points are also provided for all signals on both the terminal side (DTE) and on the modem side (DCE) of these switches to facilitate testing and patching between signal leads. Multi-Tech Systems, New Brighton, MN.
CIRCLE INQUIRY NO. 238

Graphics processing system, GPS, creates, manipulates, and edits in the manner of a word processor with text for the Apple II Plus. A grid that allows work to be done to scale and dimensions altered in proportion; six primary colors that can be mixed; two zoom features for greater detail resolution; 2-D rotation to 360;

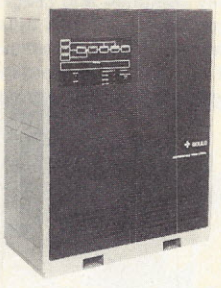
unlimited duplication of images to disk and from disk; text capabilities; overlays that

can be printed separately in different colors; and an editing capability. Stoneware, San Rafael, CA.
CIRCLE INQUIRY NO. 240

Videotex terminal, VP-3501, includes a built-in, direct-connect modem, modulated RF output, color graphics; a resident ASCII or Dynamically Redefinable Character Set (DRCS); a reverse video; a tone generator

with subcarrier audio output for sound via the TV, a software selectable large character format and an expansion interface. It is compatible with most time-sharing and database computer networks. RCA, Somerville, NJ.
CIRCLE INQUIRY NO. 239

45KVA uninterruptible power system, series UPS, features high efficiency and output in a compact size and weight.



System operational status is displayed on an illuminated mimic bus incorporating detail diagnostics that isolate problems to specific modules. Gould, Inc., San Diego, CA.
CIRCLE INQUIRY NO. 241

Acoustic couplers, FM31 and FM301, transmit and receive asynchronous, serial data at speeds up to 300 bps, originate or answer, in half- or full-duplex mode over the switched telephone networks. They feature crystal-controlled circuits and are compatible with Bell 103 and 113 type modems and interface with devices utilizing the RS-232B/C, TTL and 20mA current loop standards. Multi-Tech Systems, New Brighton, MN.
CIRCLE INQUIRY NO. 242

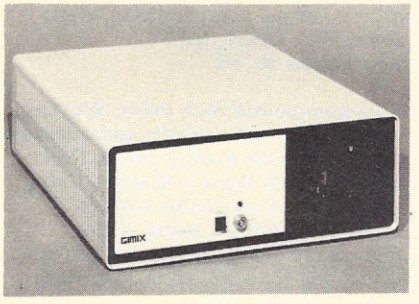
Retro-Graphics terminal upgrade, GEN. II., features Tektronix 4010 and 4027 graphics terminal emulation; mono-chromatics, gray scale and color display formats; standard-to-medium resolution; 8-bit and 16-bit microprocessors; and compatibility with most graphics software. Digital Engineering, Sacramento, CA.
CIRCLE INQUIRY NO. 243

Acoustic coupler/modem, AJ 1233, an originate-only, full duplex data communication unit communicates with Bell 212A and VA 3400 and AJ 1256/1259 series modems, and Bell 103/113 low speed modem. It is switch selectable for communications at data rates of 1200 bps synchronously or asynchronously, and from 0 to 450 bps asynchronously. It can be connected to the switched network by a modular RJ-11C ordinary telephone jack. Anderson Jacobson, San Jose, CA.
CIRCLE INQUIRY NO. 245

Four-color matrix cartridge for low-cost color graphics printers is designed in the same format as the ½-in. DPC model #79020. The cartridge houses a 1-in. ribbon having three process colors plus black in an array of non-bleeding ¼-in. bands. The hollow drive gear is provided with internal splines that permit vertical displacement of the cartridge for color selection while printing. Data Packaging Corp., Cambridge, MA.
CIRCLE INQUIRY NO. 246

RGB color monitors, 12-in. and 13-in. models, can be used with the IBM personal computer and the Apple III. TSK Electronics Corp., Duarte, CA.
CIRCLE INQUIRY NO. 250

Multiuser 6809 Winchester system supports up to four terminals and features a 2MHz 6809 CPU, 120K bytes of static RAM, a 19M-byte 5¼-in. Winchester hard disk, an IMB 5¼-in. floppy disk, and four serial I/O ports. Additional memory, mass storage capacity, and I/O for additional terminals and peripherals are optional. The



system price includes OS-9 level 2, a UNIX-like, multi-user, multi-tasking operating system and the OS—9 includes Basic09, Pascal, CIS Cobol, and C. Gimix Inc., Chicago, IL.
CIRCLE INQUIRY NO. 255

Ergonomically-designed smart terminals, TDV 2200 series, emulate virtually any terminal including the VT-100 and IBM 3101. A light colored background surrounds the text on the screen, the intensity control affects both the text and the background light, providing optimal contrast under all lighting conditions. An

anti-reflex tube and a tilt-and-swivel mechanism eliminate reflections from the tube, while the matte finish of the keytops and other surfaces minimizes reflection. Height, swivel and tilt are adjustable. Eight PUSH keys can be used with SHIFT to provide 16 functions. A total of 416 characters can be programmed and stored. Tandberg Data, Armon, NY.
CIRCLE INQUIRY NO. 244

Laser printing system, model LPS-12, is intended to be a shared office automation resource that can handle multiple originals of multipage documents. It provides high-speed, high-quality printing with a large selection of type. The unit operates at an average speed of 12 pages per minute

with print resolution of 300-by-300 dots per inch. It stores multiple character sets on the associated system disk and can support single and double underscore, slash overstrike, subscripts, superscripts, bold and vertical expanded print. Wang Laboratories, Lowell, MA.
CIRCLE INQUIRY NO. 248

Apple-compatible disk drive, Elite One, provides users with capacity approximately 14% greater than existing drives. Other features include Apple-compatible styling, increased head positioning accuracy, greater track-to-track speed, a stall provision protecting against spin motor burnout and write-protect feature. Rana Systems, Carson, CA.
CIRCLE INQUIRY NO. 249

Communications program, File Transfer Server (FTS), runs on any 64K Apple II station in a Nestar Cluster/One network. For long distance links, it supports several direct-connect Apple resident modems, as well as extended modems connected via an RS-232 serial interface. It offers the advantages of a local network but provides multiple networks with communications between the groups served by each local network. Nestar Systems, Palo Alto, CA.
CIRCLE INQUIRY NO. 251

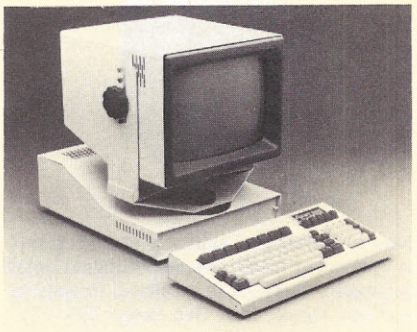
16-bit microcomputer, KDS-7860, is based on Intel's 8086 CPU. Numerous memory, storage, interface, display and peripheral options are available including color graphics and voice synthesis. The system accepts Multibus-compatible peripherals and runs CP/M and MS-DOS operating systems. Nissei Sangyo America, Ltd., Wellesley Hills, MA.
CIRCLE INQUIRY NO. 252

Desktop system, AM-100/L processor, incorporating the Motorola MC68000 chip for one or two users, supports a 5¼-in. Winchester disk. Alpha Micro, Irvine, CA.
CIRCLE INQUIRY NO. 253

Intelligent terminal systems, CDX-268 series, are capable of running applications written for either of CP/M or UNIX operating systems. The new system is fully compatible with the existing CDX-268 product capabilities. These include industry-

standard Cobol and Basic programming languages, FORMS Screen Format Design Facility, ASK Record Management System, Stylograph word processor, and compatible 2780/3780 and TTY communications protocols. Codex Corp., Mansfield, MA.
CIRCLE INQUIRY NO. 254

Video display terminal, Avant 300, is ergonomically designed and programmable. Data storage capacity of 10K bytes RAM can be loaded via downline communications from a host computer. The terminal



features character intermixing, eight user or host programmable function keys, smooth scroll, and line and block graphics capabilities. General Terminal Corp., Tustin, CA.
CIRCLE INQUIRY NO. 256

We've already written 80% of your next program.

Imagine writing better, faster business programs in 20% of the time. Now you can, with this revolutionary programming tool. Let's face it... the great majority of programming is pure busywork. Every instance of creativity may require hours of generating code. Not anymore. The Tool™ takes care of the busywork, letting you concentrate on creating.

Design attractive entry screens, validate, format, and store user input, with virtually no programming. The Tool does it for you. What used to take days — even weeks — now takes only minutes. And the result is better, faster, more professional programs.

The Tool provides an entry screen generator, a database manager, and a report formatter, each with very sophisticated capabilities.

ENTRY SCREENS:

The Tool allows you to make attractive, useful entry screens a standard part of your programs. It handles all screen editing, field formatting, and entry validation for you.

Character Validations:
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Field validations and formats:
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The Tool Operating System (TOS) allows files to span multiple disk drives. Whether you have four 20-megabyte drives or 8 floppy drives and 254 diskettes, TOS can use the storage space as one large file or several — it's up to you.

The database manager of The Tool offers: fast read and write / read and write directly to variables / over 15 million records / sequential and random access / multiple disk drives / partial and masked key lookup / Corvus or floppy support / record length as large as memory

REPORTING: easy report definition / define reports directly on screen / multiple column widths / calculations at print time / totals / paging / subtotals / page numbering / headers / title

- The Tool uses less memory than old conventional programming methods.
- The Tool's many features can be used from BASIC, giving you ultimate flexibility.
- The Tool is already tested, saving you testing and debugging time.

Using The Tool is actually like having an experienced Apple II™ programmer do most of the work for you.

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CALENDAR

Jul 6-23 Program design course, State University, Fresno, CA, workshop emphasizing design and creation of user-friendly programs for use in the classroom. Courseware Magazine, 4919 N. Millbrook #222, Fresno, CA 93726.

Jul 19-21 Summer Computer Simulation Conference, Marriott City Center Hotel, Denver, CO, covering all aspects of simulation methodology and applications. Marlene M. Moller, Aerospace Corp., Box 92957, Los Angeles, CA 90009.

Jul 19-23 Seminar on mini and microcomputers, College of Engineering, University of Michigan, Ann Arbor, MI, course to introduce scientists, engineers and managers to the relevant characteristics and application techniques of computers. Engineering Summer Conference, College of Engineering, University of Michigan, Chrysler Center, N. Campus, Ann Arbor, MI 48109.

Jul 21-23 Computers in education conference, Eugene Hilton Hotel, Eugene, OR, will explore current developments and future trends in computer-assisted teaching and learning. College of Education, University of Oregon, Eugene, OR 97403.

Jul 24-28 IACVB conference, Franklin Plaza Hotel, Philadelphia, PA, discussions of what high technology and telecommunications can do for the individual convention and visitor bureau. Int'l. Assoc. of Convention and Visitor Bureaus, 702 Bloomington Rd., Champaign, IL 61820.

Jul 25-31 Family Computer Camp, Clarkson College, Potsdam, NY, summer session combines family recreational outing with educational sessions about the use of computers. Conference and Information Center, Clarkson College, Potsdam, NY 13676.

Aug 1-4 Microcomputer Applications in Education Workshop, Cloud's Cal-Neva, Lake Tahoe, NV, focuses on computer relationships with teachers and administrators. University of Nevada, Reno Division of Continuing Education, Reno, NV 89557.

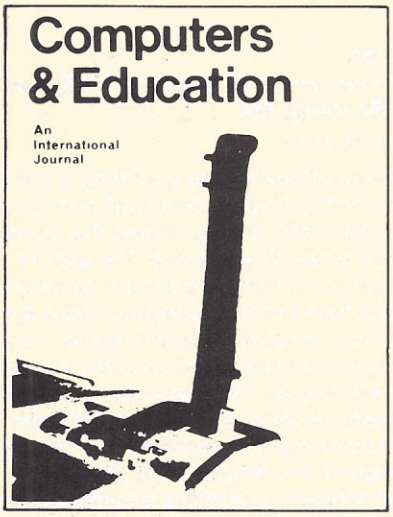
Aug 8-14 Institute for Coordinators at Academic Computing, State University College at Potsdam, NY, covers user education, and supports hardware planning, software location, conversion, and exposure to instructional software and utility. Associated Colleges of the St. Lawrence Valley, Potsdam, NY 13676.

Aug 9-13 Seminar on data communication networks, College of Engineering, University of Michigan, Ann Arbor, MI, discussion of alternative networking strategies for computer systems that use data networks. Engineering Summer Conference, College of Engineering, University of Michigan, Chrysler Center, N. Campus, Ann Arbor, MI 48109.

Aug 12-13 Microcomputers in Vocational Education Conference, Sheraton Inn, Madison, WI, will introduce beginning as well as advanced applications of software programs to vocational education curricula. Vocational Studies Center, 964 Educational Sciences Building, 1025 W. Johnson St., Madison, WI 53706.

Aug 15-18 Computer Engineering Conference and Exhibit, Sheraton Harbor Island Hotel, San Diego, CA, discussions and exhibitions on latest developments in computer engineering market. American Society of Mechanical Engineers, 345 E. 47th St., New York, NY 10017.

New Computer Journals from Pergamon



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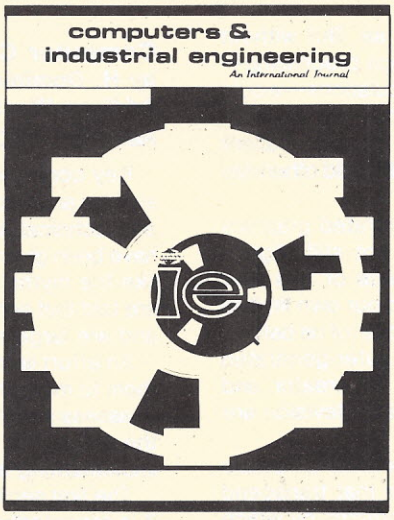

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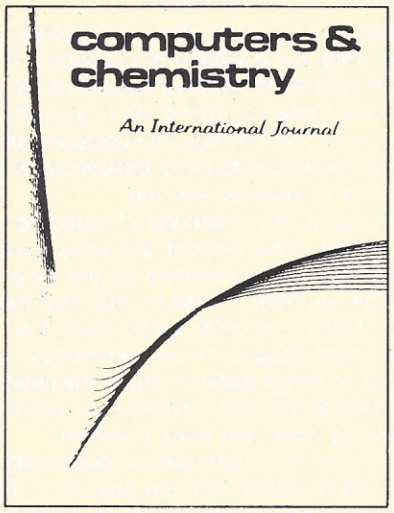
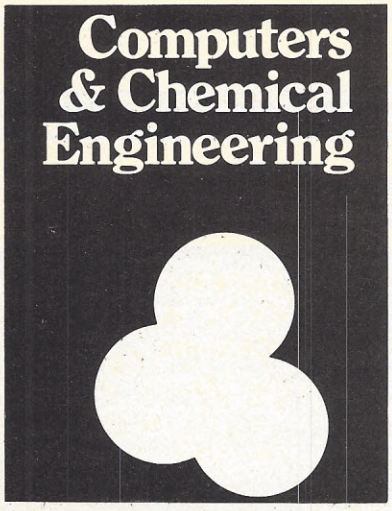
Two-year rate (1982/83) **US$304.00**



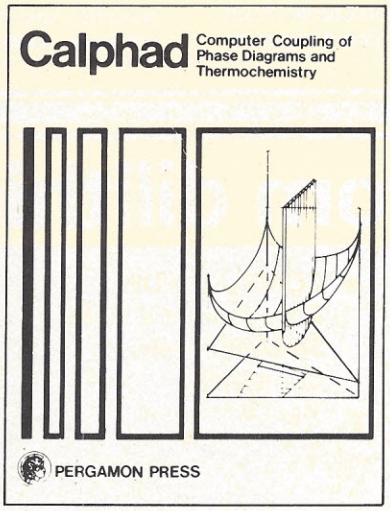
Editor: DeLos F. DeTar *Florida State University*

Published quarterly
Annual subscription (1982) **US$135.00**
Two-year rate (1982/83) **US$256.50**



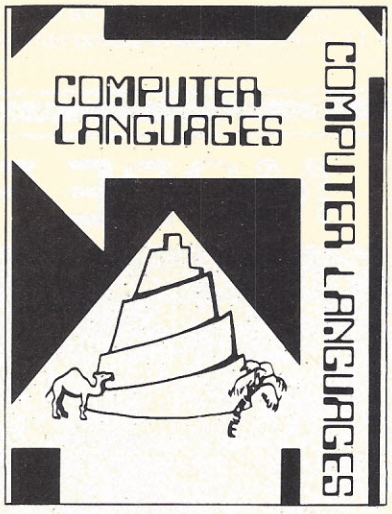
Editor: Richard R. Hughes, *Madison, Wisconsin*

Published quarterly
Annual subscription (1982) **US$135.00**
Two-year rate (1982/83) **US$256.50**



Editor-in-Chief: Larry Kaufman *Man Labs Inc., Cambridge, Mass*

Published quarterly
Annual subscription (1982) **US$175.00**
Two-year rate (1982/83) **US$332.50**



Editor: Robert S. Ledley *Georgetown University Medical Centre, Washington*

Published quarterly
Annual subscription (1982) **US$135.00**
Two-year rate (1982/83) **US$256.50**

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11/81/2B/2

BOOK REVIEWS

Algorithms for Graphics and Image Processing
by Theo Pavlidis
Computer Science Press, Rockville, MD

Reviewed by Rocky Smolin

This is not a book about computers, per se. But without computers, the discipline of graphics and image processing—based as it is on massive mathematical calculations—would not have come into being. As in so many other new fields of science and technology, the computer plays the role of silent partner, facilitating practical applications of what would otherwise remain a theoretical science.

For many, the existence of computer-generated graphics and image enhancement are ubiquitous if not still slightly mysterious. As consumers of the by-products of this new science, we have access to tools that extend our own limited vision. Pictures of outer space, views from above (of us below), false color images of our resources, computer-generated images of things existing only in the minds of the creator, and spectacular graphics exploited by commercial television are becoming more and more common.

In this book of technical and mathematical content, Pavlidis attempts to define the new science in terms that transcend transient technologies. By clarifying the algorithms by which one can perform computerized graphics and image processing, he lays the foundation for a maturing discipline.

A broad mathematical and computational background is required for this text. Calculus, elementary statistics, elementary graph theory, geometry, signal processing, data structures, analysis of algorithms and programming are included. Algorithms are in an Algol-type notation, and are therefore structured. Each of the 17 chapters contain a bibliography of pertinent literature and problems. Three indices—author, subject and algorithm—complete the book.

416 pages $24.95

Computer Choices
by H. Dominic Covvey and Neil Harding McAlister
Addison-Wesley, Reading, MA

Reviewed by Dennis Doonan

Key consumer issues of buying and operating a computer system are discussed in this book. It deals with both practical and technical issues. Generally, the text implies that computers have been given a false sense of importance. The authors would like the myths that surround computers to be dispelled. We are told that computers have become expensive status symbols and are largely oversold because of subtle social pressure.

An effort is made to educate potential consumers—allowing them to make informed choices. The consumer is encouraged to assess realistic needs, decipher sales jargon and understand the criteria for good software. The economics of buying and implementing a computer are discussed in detail.

The first section on hobbyist applications is comparatively dull. It is repeatedly emphasized that home computers are costly and most go unused after only a few days.

The next part deals with technical issues such as software and human engineering—privacy as well as functional specifications. The final portion envelops administration level issues such as funding, managing the computer and educating the staff who will use it. This work is suited to the business specialist or the scientist seeking to enhance an existing view of the field.

225 pages $8.95

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The GDC 103J-L

The only low-cost 300 bps dial modem
with the same features found in
modems which support business applications
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CIRCLE INQUIRY NO. 39

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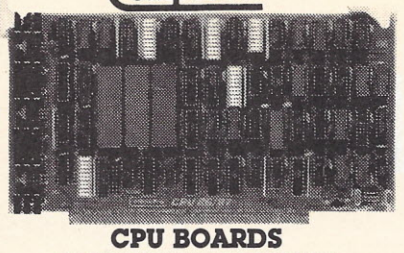


CPU BOARDS

CO-PROCESSOR 8086/8087

16 bit 8 or 10 MHz 8086 CPU with sockets for 8087 and 80130

Part No.	Description	List Price	Our Price
IGGBT186A	A&T 8MHz 8086 only	$695.00	$ 625.00
IGGBAT186C	CSC 10MHz 8086 only	$850.00	$765.00
IGGBT186A87	A&T with 8087 option	$1295.00	$1225.00
IGGBT186C87	CSC with 8087 option*	$1550.00	$1456.00

**8087 requires slower clock speeds*

DUAL PROCESSOR 8085-8088

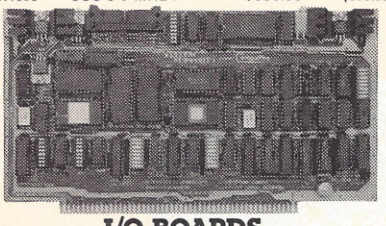
6 or 8 MHz Provides true 16 Bit Power with a standard 8 bit S-100 bus

IGGBT1612A	A&T 6Mhz	$425.00	$399.00
IGGBT1612C	CSC 6/8 MHz	$525.00	$498.00

CPU-Z Z80 CPU

2/4 MHz Z80 CPU 24 Bit Addressing

IGGBT160A	A&T	$295.00	$280.00
IGGBT160C	CSC 3-6 MHz	$395.00	$375.00



I/O BOARDS

SYSTEM SUPPORT 1 MULTIFUNCTION BOARD

Serial port (software prog. baud), 4K EPROM or RAM provision, 15 levels of interrupt, real time clock, optional math processor

Part No.	Description	List Price	Our Price
IGGBT162A	Assembled & Tested	$399.00	$360.00
IGGBT162C	CSC	$495.00	$460.00
IGGBT8231	Math Chip		$195.00
IGGBT8232	Math Chip		$195.00
IGGBT162AM1	A&T with 8231 Math Chip		$555.00
IGGBT162CM1	CSC w/8231 Math Chip		$655.00
IGGBT162AM2	A&T w/8232 Math Chip		$555.00
IGGBT162CM2	CSC w/8232 Math Chip		$655.00

MPX CHANNEL BOARD

I/O Multiplexer, using 8085A-2 CPU on board with 4K RAM

IGGBT166A4	Assembled & Tested	$495.00	$445.00
IGGBT166C4	CSC	$595.00	$535.00
	With 16K RAM		
IGGBT166A16	Assembled & Tested	$649.00	$585.00
IGGBT166C16	CSC	$749.00	$675.00

INTERFACER 1

Two Serial I/O

IGGBT133A	Assembled & Tested	$249.00	$219.00
IGGBT133C	CSC	$324.00	$298.00

INTERFACER 2

Three parallel, one serial I/O board

IGGBT150A	Assembled & Tested	$249.00	$219.00
IGGBT150C	CSC	$324.00	$289.00

INTERFACER 3

Eight channel multi-use serial I/O board

IGGBT1748A	Assembled & Tested	$699.00	$629.00
IGGBT1748C	CSC 200 hr. 8 Port	$849.00	$750.00
IGGBT1745A	Assembled & Tested	$599.00	$559.00
IGGBT1745C	CSC 200hr. 5 port	$699.00	$629.00

INTERFACER 4

Three Serial, 1 Parallel, 1 Centronics Parallel

IGGBT187A	Assembled & Tested	$350.00	$315.00
IGGBT187C	CSC	$450.00	$415.00

SPECTRUM COLOR GRAPHICS

Color Graphics board with Parallel I/O

IGGBT144A	Assembled & Tested	$399.00	$349.00
IGGBT144C	CSC	$449.00	$339.00
IGGBT2D	Sublogic Universal Graphics Interpreter Software		$35.00

S-100 MOTHERBOARDS

Active termination, 6-12-20 Slot

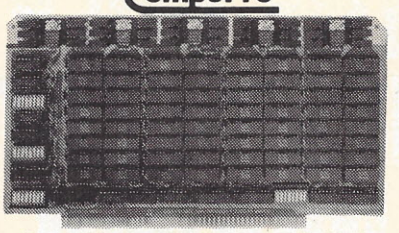
IGGBT153A	A&T 6 slot, 2 lbs.	$140.00	$126.00
IGGBT153C	CSC 6 slot, 2 lbs.	$190.00	$175.00
IGGBT154A	A&T 12 slot, 3 lbs.	$175.00	$155.00
IGGBT154C	CSC 12 slot, 3 lbs.	$240.00	$220.00
IGGBT155A	A&T 20 slot, 4 lbs.	$265.00	$235.00
IGGBT155C	CSC 20 slot, 4 lbs.	$340.00	$310.00

ACTIVE TERMINATOR

Allows older S-100 motherboards to run faster and quieter

IGGBT106A	Assembled & Tested	$59.50

CompuPro™



STATIC MEMORY BOARDS

RAM 20 - 32K STATIC RAM

RAM 20 10 MHz, 4K byte block disable, bank select or 24 bit addressing available 8, 16, 24 or 32K

Part No.	Description	List Price	Our Price
IGGBT164AA8	8K A&T	$210.00	$190.00
IGGBT164AC8	8K CSC	$280.00	$260.00
IGGBT164AA16	16K A&T	$285.00	$260.00
IGGBT164AC16	16K CSC	$355.00	$325.00
IGGBT164AA24	24K A&T	$355.00	$325.00
IGGBT164AC24	24K CSC	$425.00	$385.00
IGGBT164AA32	32K A&T	$425.00	$385.00
IGGBT164AC32	32K CSC	$495.00	$450.00

CMOS STATIC RAM

For a complete analysis of the advantages of CMOS memory, see the "Product Description" on page 416 of the January Issue of **BYTE**

RAM 17 - 64K CMOS STATIC RAM

RAM 17, 10 MHz, 2 Watt, DMA Compatible 24 Bit Addressing

IGGBT175A64	64K A&T	$599.00	$550.00
IGGBT175C64	64K CSC	$750.00	$699.00

RAM 16 - 32K x 16 BIT CMOS STATIC RAM

8 and/or 16 Bit
816 RAM 16 10 MHz, 32K x 16 or 64K x 8
IEEE/696 16 Bit 2 Watt, 24 Bit Addressing

IGGBT180A	64K A&T	$650.00	$599.00
IGGBT180C	64K CSC	$750.00	$699.00

NEW! RAM 21 - 128K STATIC RAM

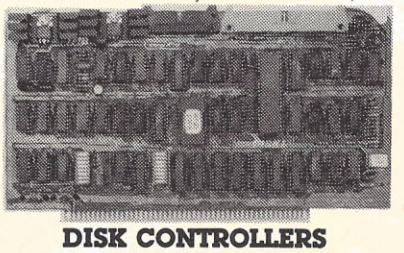
816 RAM 21 12MHz, 128K x 8 or 64K x 16
IEEE/696 8 or 16 Bit 1.2 Amps, 24 Bit Addressing

IGGBT190A	128K A&T	$1695.00	$1610.00
IGGBT190C	128K CSC	$1895.00	$1795.00

M-DRIVE SOLID STATE DISK DRIVE, 3500% FASTER!

Not Really, But the Next Best Thing for CompuPro 8085/88 Users. Call for Detail on M-Drive.
M-Drive requires a 6MHz CPU 8085/88 dual processor, Disk 1 DMA disk controller and System Suport 1 Multifunction Board

IGGBTMD128K	128K of A&T memory & M-DriveSoftware	$1198.00
IGGBTMD128KC	128K of CSC memory & M-Drive Software	$1398.00
IGGBTMD256KA	256K of A&T memory & M-DriveSoftware	$2395.00
IGGBTMD256KC	256K of CSC memory & M-Drive Software	$2795.00



DISK CONTROLLERS

DISK 1 FLOPPY CONTROLLER

Fast DMA, Soft Sector, Controls 8" or 5¼" Single or Double Density. OUR BEST!

IGGBT171A	A&T	$495.00	$450.00
IGGBT171C	CSC	$595.00	$555.00
IGGBTCPM80*	CP/M 2.2 for Z80/8085 with manuals & BIOS 8" S/D disk		$175.00
IGGBTCPM86	CP/M for 8086 with manuals & BIOS 8" S/D disk		$300.00
IGGBTOAS8S	Oasis 8 bit single user 8"S/D disk		$500.00
IGGBTOAS8M	Oasis 8 bit multiuser, 8" S/D disk		$850.00

DISK 2/SELECTOR CHANNEL HARD DISK CONTROLLER

Fast DMA 2 board set.Controls 4 Shugart 4000 series or Fujitsu 2300 type drives

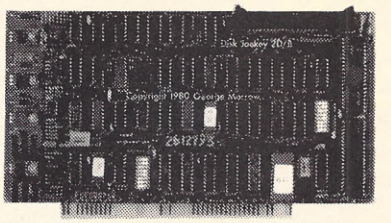
IGGBT177A	Assembled & Tested	$795.00	$750.00
IGGBT177C	CSC	$895.00	$850.00

S-100 MAINFRAME

110V 60Hz CVT Mainframe uses famous 20 slot COMPUPRO Motherboard. 55 lbs.

IGGBTENC20RM	20 Slot Rack Mount	$895.00	$825.00
IGGBTENC20DK	20 Slot Desk Top	$825.00	$760.00

MORROW DESIGNS



FLOPPY DISK CONTROLLERS & SUBSYSTEMS

DISK JOCKEY 2B FLOPPY CONTROLLER

Memory mapped controller handles 4 8" drives, single or double density

Part No.	Description	List Price	Our Price
IGMDSDJ2208	A&T w/CP/MX 2.2	$399.00	$375.00

DISCUS 2D & DISCUS 2+2 SUBSYSTEMS

Each subsystem includes DJ/2B controller 8" double density drives with cabinet, power supply, CP/MX 2.2 and Microsoft Basic

SINGLE SIDED - DISCUS 2D

IGMDSF1218	1 Drive	30 lbs.	$1095.00	$ 950.00
IGMDSF1228	2 Drive	48 lbs.	$1875.00	$1675.00

DOUBLE SIDED - DISCUS 2+2

IGMDSBF812	1 Drive	30 lbs.	$1395.00	$1250.00
IGMDSBF822	2 Drive	48 lbs.	$2495.00	$2200.00

DISK JOCKEY/DMA FLOPPY CONTROLLER

DMA Controller supports 4 soft-sectored 8" drives and 4 10 sector 5¼" drives simultaneously. On board Z80A

IGMDSDJDMA	A&T w/CP/MX 2.2	$495.00	$450.00

DISK JOCKEY DMA SUBSYSTEMS

Each subsystem includes DJ/DMA controller, 8" double-density drives or 5¼" 48 TPI drives, cabinet, power supply, CP/MX 2.2 and Microsoft BASIC

SINGLE SIDED DISCUS 2D/DMA

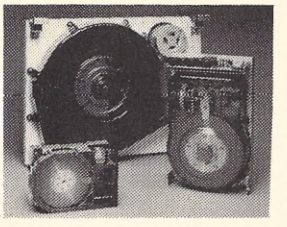
IGMDSDF811	1 Drive	30 lbs.	$1195.00	$1050.00
IGMDSDF821	2 Drive	48 lbs.	$1975.00	$1775.00

DOUBLE SIDED DISCUS 2+2/DMA

IGMDSDF812	1 Drive	30 lbs.	$1495.00	$1325.00
IGMDSDF822	2 Drive	48 lbs.	$2575.00	$2295.00

DOUBLE SIDED - DISCUS MINI-FLOPPY/DMA

IGMDSDF5124	1 Drive	17 lbs.	$ 995.00	$895.00
IGMDSDF5224	2 Drive	32 lbs.	$1695.00	$1525.00



S-100 5-26 MB HARD DISK SUBSYSTEMS

5 - 10 Mb DMA SUBSYSTEMS

Each subsystem includes DMA Hard Disk Controller, Seagate ST506 5 Mb or ST412 10 Mb 5¼" Hard Disk, Cabinet, power supply, CP/MX2.2 and Microsoft BASIC.

IGMDSDMAM*	Software supplied on 8" IBM 3740 disk with blank I/O and INSTALL program
IGMDSDMAM*2B	Software configured for Morrow DJ/2B controller and Muit I/O as console
IGMDSDMAM*DMA	Software configured for Morrow DJ/DMA controller and Mult I/O as console
IGMDSDMAM*5S	Software supplied on 5¼"soft sector(IBM /Cromemco disk w/blank I/O & INSTALL Program
IGMDSDMAM*NS	Software suplied on 5¼" 10 sector North Star disk with blank I/O and INSTALL Program

*Replace * in above part numbers with* **5** *for 5Mb Subsystems or* **10** *for 10Mb Subsystems.*

IGDISCUSM5 -	5Mb Subsystems	$2195.00	$1975.00
IGDISCUSM10 -	10Mb Subsystems	$3195.00	$2875.00

(order by part numbers listed above)

DISCUS HDC 20-26 Mb SUBSYSTEMS

Each subsystem includes HDCA3 I/O mapped controller, Shugart SA4008 14" 26Mb or Fujitsu 2308 8" 20Mb Hard Disk, cabinet, power supply, CP/MX2.2 & Microsoft BASIC.

IGMDSHDC20	Discus M20 A&T	$4795.00	$3995.00
IGMDSHDC26	Discus M26 A&T	$4495.00	$3895.00

I/O BOARDS

MULTI I/O

Three Serial, Two Parallel

IGMDSMB3200	Assembled & Tested	$359.00	$329.00

SWITCHBOARD

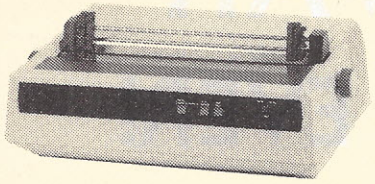
Two serial I/O, four parallel I/O, one status port, one strobe port

IGMDSSB2411		$299.00	$269.00

PRIORITY ONE ELECTRONICS

FUJITSU & NEC

LETTER QUALITY PRINTERS FROM SELLUM



Interfaces: ● RS232C and Current Loop ● Centronics type parallel interface ● IEEE/488 All are DIP switch selectable.
Personality Protocols: ● NEC5510 ● DIABLO 630 ● QUME Sprint 9 ● IBM Personal Computer ● ATARI (Centronics 737).
Special Features: ● Z80 CPU ● 12K ROM ● Standard 16K Buffer ● Optional 48K Buffer ● 50 - 19.2K baud ● Micro-coded alarm differentiates error conditions with pulse combinations ● Intelligent bi-directional printing with logic seeking ● Complete word processing features ● Self test ● Auto reprint ● Auto clear error ● Proportional spacing ● Supports Automatic justification ● Complete Vector plotting routines ● Sheet feeder mode allows easy interface to most mechanical sheet feeders ● 6 month warrantee ● Quiet - 60db ● Front panel forms control ● Universal power supply 115/220V 50/60 Hz.

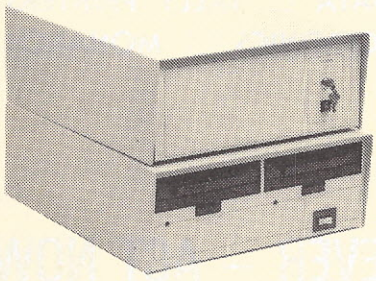
80 CPS USING THE FUJITSU SP830

Part No.	Description	List Price	Our Price
IGSLMF86	Intelligent Printer	$3495.00	$2995.00
	OPTIONS		
IGSLMF86VFT	Vertical forms tractor		$200.00
IGSLMF8648K*	48K RAM buffer		$400.00
	Call for pricing on sheet feed options		

55 CPS USING THE NEC 7700

IGSLMN77	Intelligent Printer	$3295.00	$2895.00
	OPTIONS		
IGSLMN77VFT	Vertical Forms Tractor		$ 230.00
IGSLMN77BDFT	Bidirectional Forms Tractor		$ 400.00
IGSLMN77CSF	NEC Cut Sheet Feeder		$1595.00
IGSLMN77CSF2	Twin Cut Sheet Feeder		$2150.00
IGSLMN7748K*	48K RAM Buffer		$ 400.00
	*Must be ordered with the printer		
	INTERFACE CABLES		
IGCPAM572	Centronics IBM/NEC Cable		$80.00
IGSCDB251	RS232C Serial Cable		$60.00
	Call for other cables not listed		

Para Dynamics



18 SLOT S-100 MAINFRAME

CVT Power Supply, forced air cooling; security lock 120 or 220V AC at 50 or 60Hz+8V@20A, ±16@3.5

IGPDN2018D	Desk Top	$799.00	$699.00
IGPDN2018R	Rack Mount	$849.00	$749.00

8 SLOT S-100 MAINFRAME WITH CUTOUTS FOR 2 5¼" DISK DRIVES

+5@5A, -5@500MA, +8@15A, +12@6A, +16@2, -16@2

IGPDN2508D	Desk Top	$899.00	$789.00
IGPDN2508R	Rack Mount	$949.00	$839.00

DISK DRIVE FACILITY

Accommodates two 8" floppy drives, of Shugart, Qume, or similar design and dimensions. 110 or 220V AC at 50 or 60Hz CVT power.

IGPDN2200D	Desk Top	$659.00	$579.00
IGPDN2200R	Rack Mount	$679.00	$595.00

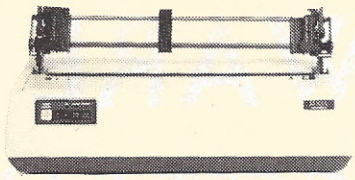
PRONTO

Free standing cabinet. Will accept 2, 8" Floppy disks and 1, 8" Rigid disk. 18 slot card cage will accept the double height 10" x 10" S-100 cards (Alpha Micro and others) CVT Power Supply.

+24@7A, +16@2.2A, -16@3.5A, +8@20A, +5@5A

IGPDN2818	PRONTO	$1295.00	$1129.00
	PRONTO COMPLETE WITH POWER SUPPLY POWER-UP SEQUENCER		
IGPDN2818S	with sequencer	$1395.00	$1249.00
	Shipped motor freight collect		

OKIDATA



- *BI-DIRECTIONAL-120 CPS*
- *9x9 Matrix (Alphanumeric)*
- *100 Thru 1200 Baud*
- *6x9 or 12 matrix for graphics*
- *Self Test*
- *5,8.3,10,16 Characters p/Inch*
- *Out of paper switch*
- *6 or 8 Lines per Inch*
- *Friction or Tractor Feed*
- *80 CPL@10 CPI for 82A*
- *3" to14" Top of form*
- *132 CPL@10 CPI for 83A & 84*
- *(Switch Selectable)*
- *10 Different Character Sets*
- *Parallel and Serial I/O*

The above printers come complete with friction and tractor feed. Front panel selection of 10 different form lengths. Front or bottom paper loading for up to 4 part forms and tear bar. All three printers have a parallel interface as standard. The 82A and 83A also include a 1200 baud serial interface as standard.

Part No.	Description	List Price	SALE
IGOKIDAT82AT	80 column printer w/tractor (25 lbs.)		$539.00
IGOKIGRAPH82	High resolution graphics ROM 60x66		$ 75.00
IGOKIDAT83AT	132 column printer w/tractor (35 lbs.)		$750.00
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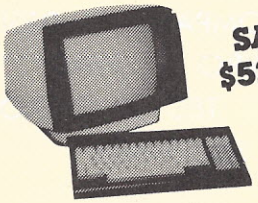

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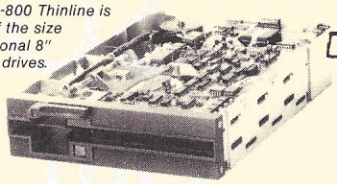

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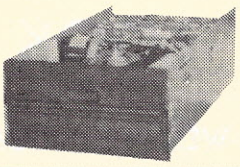

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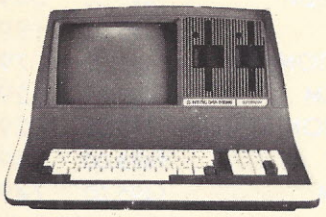

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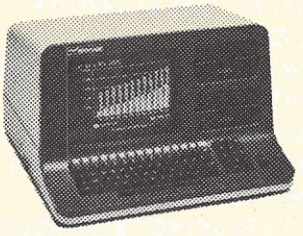

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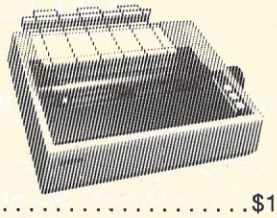

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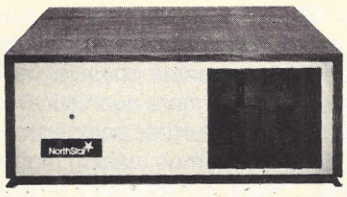

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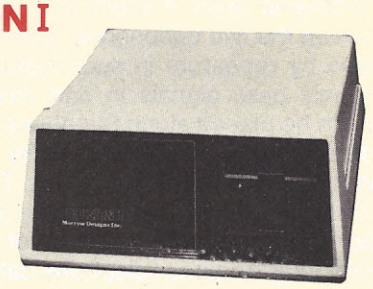

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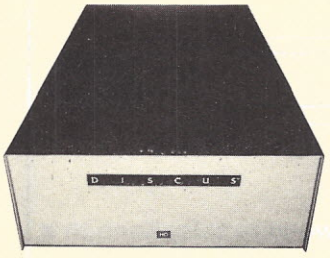

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CIRCLE INQUIRY NO. 102

Computer Communications Using the Telephone Network

Continued from page 76

to party A. Although this technique works well over short distances, problems arise if there is a considerable distance between the two telephones. The signals need to be amplified by repeaters in such instances.

Amplifiers only pass signals in one direction so if repeaters are to be placed along telephone lines, there must be a different pair of wires for party A to talk to party B, than for party B to talk to party A. This is called a four-wire or trunk circuit, and is shown in figure 7b.

In the national DDD network, because of the need to amplify signals, long distance telephone calls are transmitted using four-wire circuits. However, the connection

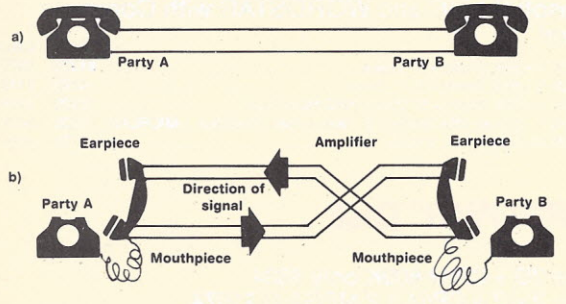

Figure 7. Two- and four-wire connections

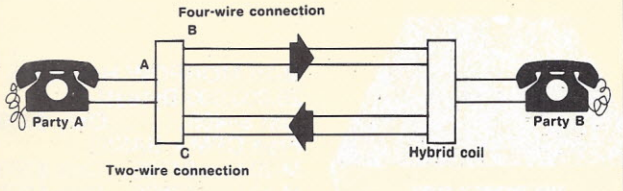

Figure 8. Connecting a two-wire telephone to a four-wire line.

between a subscribers' telephone and the local exchange has traditionally been with two-wire circuits, the signals being transmitted over this part of the network without amplification. Thus, a conversion must be made between the two-wire circuits used locally and the four-wire circuits used for long distance transmissions. This is performed using a hybrid coil, shown as a rectangle in figure 8. The hybrid coil operates as follows: a signal from party A entering the coil at A will be sent out through B, but not through C. A signal from party B entering the coil at C will be sent out through A, but not through B. The transition from two-wire to four-wire circuits is easily performed by the telephone companies using hybrid coils—they are located at the local telephone exchange.

A user who decides to dedicate a long distance telephone line between the main computer and a remote terminal can, at little extra cost, ask the local telephone company to connect his computer to the local exchange using a four-wire circuit. Two voice grade telephone circuits can be obtained for slightly more than the cost of a single circuit. In a practical application, one circuit transmits data from the computer to the remote terminal, the others transmit data from the remote terminal to the computer. In almost every computer communications application, the user can benefit from the addition of this extra circuit.

When a telephone company establishes a dedicated line, it uses slightly different circuitry than that used in the DDD network. This circuitry improves the network's ability to transmit data, as distinct from voice messages. With the DDD network, a different physical path would probably be followed every time the system was accessed. With a dedicated line the same physical path is used each time. It is possible to add more sophisticated conditioning circuits along the line to further compensate for delay and attenuation distortion—thus making higher transmission rates possible. There are different grades of conditioning available, each higher grade specifying a tighter tolerance on delay or attenuation distortion. The benefits of higher transmission rates must be weighed against the cost of providing the extra conditioning.

In the DDD network, some frequencies in the range 300 Hz to 3,400 Hz are used for signaling purposes by the telephone company. For example, a single tone of 2,600 Hz would cause the telephone company's switching equipment to disconnect the line. If a computer's modem used any of these frequencies to communicate with the remote terminal's modem, and at the same time put little or no signal on the line at other frequencies, the computer could interfere with the operation of the line.

With a dedicated line, the channel is used exclusively by computer and terminal. There are no frequencies allocated for signaling purposes; the entire bandwidth of the telephone line is available to the user.

By Shannon's Law, the maximum information that can be transmitted along a communications channel is:

$$W \log \left\{ 1 + \frac{S}{N} \right\}$$

W is the bandwidth of the channel in Hz, and S/N is the signal to noise ratio of the channel.

It can be seen from this formula that if the bandwidth of the channel is increased (which is what happens if the control signal frequencies are used for communications), the amount of information that can be transmitted along the channel is also increased. Alternatively, if the amount of information transmitted were kept constant, the number of bits that would be received erroneously due to line noise would decrease. It can be inferred that a dedicated line has a greater efficiency than a DDD line.

The public telephone system, with a bandwidth of 3,100 Hz (3,400 Hz - 300 Hz), can support data transmissions using modems at rates up to 4,800 bits/second. A dedicated line with additional conditioning could transfer data at rates up to 9,600 bits/second. A two-to-one improvement in data transfer rates can be obtained by using an appropriately conditioned dedicated line.

Telephone companies are beginning to introduce digital transmission facilities for computer communications, but these are not yet widely available.

Many new types of innovative communication equipment is being introduced every year. The use of the telephone network for computer communications is increasing at a phenomenal rate. As this growth continues, the techniques introduced here will become more and more common.□

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Micro-Mathematician

Continued from page 42

Listing 1 a)

```
10 PRINT "MATROP - MATRIX OPERATIONS - 820315"
15 REM J C NASH FOR INTERFACE AGE
20 REM DIMENSION SOME ARRAYS AND VECTORS
25 DIM A(20,20),R(20,20),B(20),X(20),C(20,20),Y(20),H(20,20)
30 INPUT "NUMBER OF ROWS IN MATRIX A=",M
35 INPUT "NUMBER OF COLUMNS IN MATRIX A=",N
40 LET Q=M-N \ REM Q EXTRA ROWS
45 PRINT "ENTER MATRIX "
50 FOR I=1 TO M
55 FOR J=1 TO N
60 PRINT "A(",I,",",J,")=",
65 INPUT A(I,J)
70 LET C(I,J)=A(I,J) \ REM COPY
75 NEXT J
80 PRINT "B(",I,")=",
85 INPUT B(I)
90 NEXT I
95 REM ****
100 REM SUBROUTINE CALL TO ALLOW COMMON DRIVER
105 REM ****
110 GOSUB 400
115 REM NOW SOLVE FOR LS SOLUTION
120 FOR J=1 TO N \ REM FORM QT*B
125 LET S=0
130 FOR I=1 TO M
135 LET S=S+A(I,J)*B(I)
140 NEXT I
145 LET Y(J)=S
150 NEXT J
155 GOSUB 1500 \ REM BACK - SUBSTITUTION
160 PRINT "SOLUTION"
165 FOR I=1 TO N
170 PRINT "X(",I,")=",X(I)
175 NEXT I
180 PRINT "RESIDUALS"
185 LET T=0 \ REM SUM OF SQUARED RESIDUALS
190 FOR I=1 TO M
195 LET S=B(I)
200 FOR J=1 TO N
205 LET S=S-C(I,J)*X(J)
210 NEXT J
215 PRINT S,
220 IF 5*INT(I/5)=I THEN PRINT
225 LET T=T+S*S
230 NEXT I
235 PRINT
240 PRINT "RESIDUAL SUM OF SQUARES=",T
245 STOP
```

b)

```
400 PRINT "MORTHOGS - MODIFIED GRAM SCHMIDT "
410 REM 820315 J C NASH
420 LET T9=1E-6 \ REM NORM OF VECTORS MUST EXCEED T9
430 LET Q=M-N \ LET P=0 \ REM FOR ELIMINATION SUBS.
440 REM WORKS ROW BY ROW IN FORMING TRIANGULAR MATRIX
450 FOR I=1 TO N \ REM LOOP OVER COLUMN VECTORS
460 REM NORMALIZE
470 LET S=0
480 FOR J=1 TO M
490 LET S=S+A(J,I)*A(J,I)
500 NEXT J
510 LET R(I,I)=SQRT(S)
520 IF R(I,I)<T9 THEN STOP \ REM SAFETY CHECK
530 FOR J=1 TO M
540 LET A(J,I)=A(J,I)/R(I,I)
550 NEXT J \ REM NORMALIZATION
560 IF I=N THEN 650
570 FOR K=I+1 TO N
580 LET S=0
590 FOR J=1 TO M
600 LET S=S-A(J,I)*A(J,K)
610 NEXT J
620 LET R(I,K)=-S
630 GOSUB 1100 \ REM SUBTRACT
640 NEXT K
650 GOSUB 800 \ REM PRINT THE VECTOR
660 NEXT I
670 REM DONE - PRINT THE INNER PRODUCT MATRIX
680 GOSUB 2000
690 PRINT "INNER PRODUCTS  B = AT * A "
700 FOR I=1 TO N
710 PRINT "ROW ",I
720 FOR J=1 TO I
730 PRINT H(I,J),
740 IF 5*INT(J/5)=J THEN PRINT
750 NEXT J
760 PRINT
770 NEXT I
780 PRINT "DEVIATION FROM UNIT MATRIX / ELEMENT=",D
790 RETURN \ REM DONE
800 PRINT "ORTHONORMAL VECTOR ",I
810 FOR J=1 TO M
820 PRINT A(J,I),
830 IF 5*INT(J/5)=J THEN PRINT
840 NEXT J
850 PRINT
860 PRINT N-I+1," LAST ELEMENTS OF ROW ",I," OF R MATRIX"
870 FOR J=I TO N
880 PRINT R(I,J),
890 IF 5*INT(J/5)=J THEN PRINT
900 NEXT J
910 PRINT
920 RETURN
930 PRINT "FAILURE - NORMALIZATION CANNOT BE COMPLETED"
940 STOP
```

c)

```
1500 REM BACK-SUBSTITUTION FOR R*X=Y
1510 FOR I=N TO 1 STEP -1
1520 LET S=Y(I)
1530 IF I=N THEN 1570
1540 FOR J=I+1 TO N
1550 LET S=S-R(I,J)*X(J)
1560 NEXT J
1570 LET X(I)=S/R(I,I)
1580 NEXT I
1590 RETURN
1600 REM *****
```

d)

```
2000 REM INNER PRODUCT MATRIX H = AT * A
2010 LET D=0 \ REM MEASURE
2020 FOR I=1 TO N
2030 FOR J=1 TO I
2040 LET S=0
2050 FOR K=1 TO M
2060 LET S=A(K,I)*A(K,J)+S
2070 NEXT K
2080 IF I=J THEN LET D=D+ABS(S-1) ELSE LET D=D+ABS(S+S)
2090 LET H(I,J)=S
2100 LET H(J,I)=S
2110 NEXT J
2120 NEXT I
2130 LET D=D/(N*N)
2140 RETURN
```

Listing 2

```
RUN

MATROP - MATRIX OPERATIONS - 820315
NUMBER OF ROWS IN MATRIX A=6
NUMBER OF COLUMNS IN MATRIX A=2
ENTER MATRIX
A( 1, 1)=?1
A( 1, 2)=?1
B( 1)=?30.006
A( 2, 1)=?2
A( 2, 2)=?1
B( 2)=?44.013
A( 3, 1)=?1
A( 3, 2)=?2
B( 3)=?46.006
A( 4, 1)=?2
A( 4, 2)=?3
B( 4)=?76.012
A( 5, 1)=?2
A( 5, 2)=?5
B( 5)=?108.010
A( 6, 1)=?2
A( 6, 2)=?4
B( 6)=?92.011
MORTHOGS - MODIFIED GRAM SCHMIDT
ORTHONORMAL VECTOR  1
 .23570226 .47140452 .23570226 .47140452 .47140452
 .47140452
 2 LAST ELEMENTS OF ROW  1 OF R MATRIX
 4.2426407 6.8353656
ORTHONORMAL VECTOR  2
 -.20063107 -.72956753 .12767432 -7.2956746E-02 .58365404
 .25534864
 1 LAST ELEMENTS OF ROW  2 OF R MATRIX
 3.0459445
INNER PRODUCTS  B = AT * A
ROW  1
 1
ROW  2
 .00000001 1
DEVIATION FROM UNIT MATRIX / ELEMENT= 5E-09
SOLUTION
X( 1)= 14.006916
X( 2)= 15.999294
RESIDUALS
 -.00021 -.000126 .000496 .000286 -.000302
 -.000008
RESIDUAL SUM OF SQUARES= 4.79056E-07
STOP IN LINE 400
READY
```

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Power in Your Pocket

Continued from page 50

```
  : R=0
    - Set S for accumulation of total
      cost.
  : S=0
    - Set T for accumulation of total
      items.
  : T=0
    - Set flag for printer: zero if not
      used. (If the printer will never
      be used, delete this line and all
      tests of P.)
15: P=1
    - Enter any character to clear
      printer flag.  Use ENTER only if
      the printer will be used.
  : INPUT "USE PRINTER? ";I$
  : P=0
    @@@  GET COSTS  @@@
    - Accumulate purchase cost. If the
      total cost of goods will always
      be known, this segment can be de-
      leted.  (Lines 25-35)  Total
      costs can be entered as part of
      the routine beginning at line 40.
20: Z=0
  : INPUT "COST/UNIT? $";Z
    - Exit on zero cost.  (Only ENTER
      was pressed.)
25: IF Z=0 THEN 40
30: INPUT "# OF UNITS? ";Y
    - Collect cost of current entry
      to total cost.
  : S=S+YZ
    - Collect quantity to total
      quantity.
  : T=T+Y
    - Display entry if printer.
  : IF P PRINT Y;" ITEMS"
  : PRINT "AT $";Z;" EACH"
    - Return for next entry.
35: GO TO 20
    - Display total quantity and
      average cost/unit.
40: PRINT "TOT QTY=";T
    - Find average cost.
  : Z=S/T
    - Round to tenth of cent.
  : GO SUB 295
  : PRINT "AVE COST=$";Z
  : PRINT "TOT COST=$";S
    - Add additional costs, such as
      shipping, advertising, etc. Note
      that discounts taken can be en-
      tered as negative amounts.
60: Z=0
  : INPUT "ADD COST? $";Z
    - Exit on zero cost. (Only ENTER
      was pressed.)
65: IF Z=0 THEN 80
    - Output if printer.
70: IF P INPUT "DESC? ";I$
  : PRINT I$;"=$";Z
    - Accumulate to total cost.
75: S=S+Z
    - Return for next entry.
  : GO TO 60
    - Output final cost per unit.
80: PRINT "WITH ";T;" ITEMS"
    - Find average.
  : Z=S/T
    - Round to tenth of cent.
  : GO SUB 295
85: PRINT "AVERAGE COST NOW"
  : PRINT "$";Z;"/UNIT"
  : PRINT "TOT COST=$";S
    @@@  QUANTITY SOLD  @@@
100: Z=0
  : INPUT "QUANTITY SOLD? ";Z
    - Exit on zero quantity. (Only
      ENTER pressed.)
105: IF Z=0 THEN 125
110: INPUT "AT PRICE OF? $";Y
115: IF P PRINT Z;" ITEMS SOLD"
  : PRINT "AT $";Y;"/UNIT"
    - Accumulate total sales price.
120: R=R+YZ
    - Accumulate total sales.
  : Q=Q+Z
    - Return for next entry.
  : GO TO 100
    - Output totals.
```

```
125: PRINT "QTY SOLD=";Q
     - Find average price per unit.
   : Z=R/Q
     - Round to nearest tenth of cent.
   : GO SUB 295
   : PRINT "AVE PRICE=$";Z
   : PRINT "TOT SALES=$";R
     @@@  PERCENT PROFIT  @@@
     - Find amount of profit or remain-
       ing cost if negative.
150: Y=R-S
     - Compute percent profit to date
       as a percent of sales.  Change R
       to S if percent of cost is
       needed.
   : Z=Y/R
     - Round to nearest thousandths.
   : GO SUB 295
     - Convert to a percent.
   : Z=100Z
     - Display amount and percent.  If
       negative, represents unrecovered
       costs.
155: PRINT "TOT GROSS=$";Y
   : PRINT Z;"% OF COST"
     @@@  QUANTITY FOR BREAKEVEN  @@@
     - Compute quantity remaining.  Can
       re-start with RUN 200 to adjust
       quantity remaining as needed.
200: X=T-Q
   : PRINT "QTY LEFT=";X
     - Use ENTER only to hold computed
       quantity.
   : INPUT "ADJUSTED QTY? ";X
   : IF P PRINT "NEW QTY=";X
     - Get planned future price.
205: INPUT "EST FUTURE PRICE? $";W
   : IF P PRINT "FUT PRICE=$";W
     - If total gross sales (computed
       above in line 155) exceed total
       costs, skip the balance of this
       segment.  Breakeven has been
       achieved.
210: IF Y PRINT "PAST BREAKEVEN"
   : GO TO 250
     - Compute quantity to be sold at
       the expected future price for
       breakeven.
```

```
230: Z=INT(-Y/W)+1
   : PRINT "AT $";W;"/UNIT"
   : PRINT "NEED ";Z;" SALES"
   : PRINT "FOR BREAKEVEN"
     @@@  PROJECT PROFITS  @@@
     - Compute total gross profit: pre-
       vious gross plus expected gross
       at future price.  Assume all
       units sold.
250: Z=Y+XW
   : PRINT "PROFIT=$";Z
     - Compute percent of cost.
   : Z=Z/S
   : GO SUB 295
   : Z=100Z
   : PRINT Z;"% OF COST"
     - Return for another estimate of
       future price.  BREAK for another
       run from start.
255: GO TO 205
     - Subroutine: Round to nearest
       tenth of a cent.
295: Z=INT(1000Z+.5)/1000
   : RETURN
999: END
```

SAMPLE RUN

```
PROFIT
(Any character for "NO". ENTER only, for
"YES".)
USE PRINTER? ENTER

COST/UNIT? $9
# OF UNITS? 100
100. ITEMS
AT $9. EACH

COST/UNIT? $8
# OF UNITS? 500
500. ITEMS
AT $8. EACH

(Use zero cost or ENTER only for exit.)
COST/UNIT? $ENTER

(Display totals.  Since new totals are
displayed again, after adding other
costs, these results may not be needed.)
TOT QTY=600.
AVE COST=$8.167
TOT COST=$4900.

(Enter any additional costs.)
```

```
ADD COST? $40
DESC? FREIGHT
FREIGHT $40.

ADD COST? $24
DESC? INT CST
INT CST=$24.

(Use zero cost or ENTER only for exit.)
ADD COST? $ENTER

(Summarize, with additional costs.)
WITH 600. ITEMS
AVERAGE COST NOW
$8.273/UNIT
TOT COST=$4964.

QUANTITY SOLD? 100
AT PRICE OF? $20
100. ITEMS SOLD
AT $20./UNIT

QUANTITY SOLD? 100
AT PRICE OF? $19.
100. ITEMS SOLD
AT $19./UNIT

(Use zero or ENTER only for exit.)
QUANTITY SOLD? ENTER

(Summarize sales.)
QTY SOLD=200
AVE PRICE=$19.5
TOT SALES=$3900.

(Profits thus far.  A negative amount
represents unrecovered costs.)
TOT GROSS=$-1064.
-27.3% OF COST

QTY LEFT=400.
(Quantity can be adjusted to reflect
actual remaining inventory.  Use ENTER
only to hold computed value.)
ADJUSTED QTY? 374
NEW QTY=374.

(Enter an expected average price for
future sales.)
EST FUTURE PRICE? $17
FUT PRICE=$17.

(Display final results.)
AT $17./UNIT
NEED 63. SALES
FOR BREAKEVEN

PROFIT-$5294
106.6% OF COST

(Return for a new estimate of future
price.  BREAK for a new run.)
EST FUTURE PRICE? $15
```

Commodore Logbook

Continued from page 55

Listing 1

```
Program:          10 INPUT A,B
                  20 ON A GOTO 80,30,80
                  30 FOR J = 1 TO B
                  40 IF J = B GOTO 50
                  45 C = C + B
                  50 NEXT J
                  60 GOTO 90
                  70 PRIN A
                  80 D = D + A
                  90 END

HESCOUNT OUTPUT: LINE#      COUNT
                   10         1
                   20         1
                   30         1
                   40         3
                   45         2
                   50         3
                   60         1
                   70         0
                   80         0
                   90         1
```

Listing 2

```
0   PRINT "[CS][CD][CD]HESLISTER ROM
    3&4 8K DISK R1.2 3/17/81
2   FOR R=T TO U:
      R=LEN(T$(R)):
      S=T+2:
      FOR S=R TO R9:
        F=F+S:
        IF S>10
        THEN F=0:
        F1=0:
        S=T-2
3   NEXT:
    IF T$(R)>CHR$(161) AND T$(R)
    <=CHR$(223)
    THEN J=4-S:
      ON J
      GOSUB 6,8,10
4   NEXT
```

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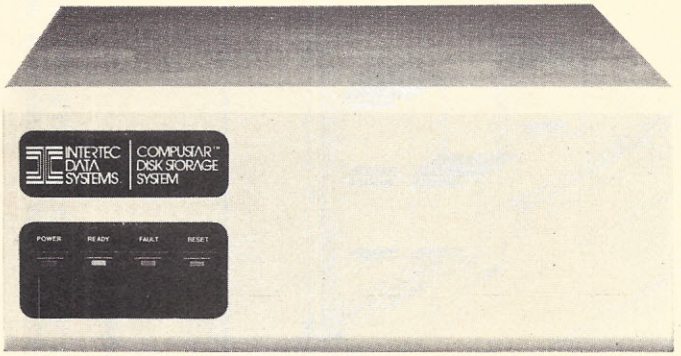

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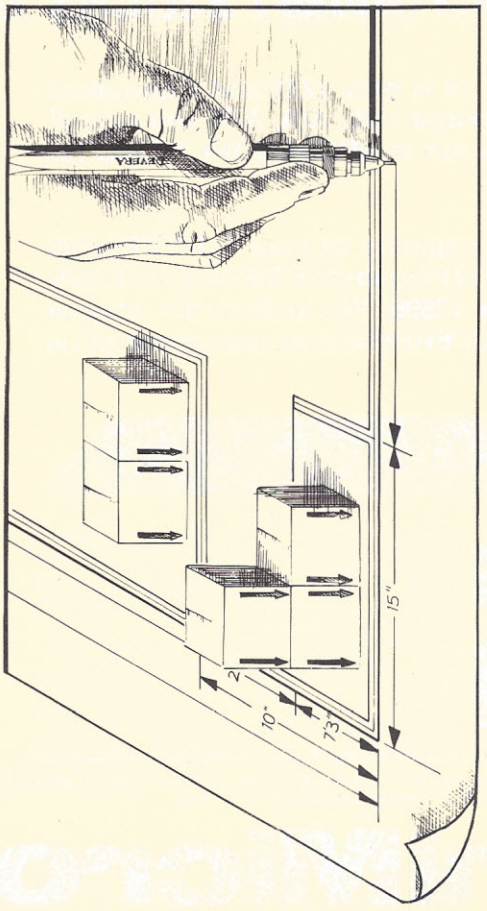
CIRCLE INQUIRY NO. 111

```
270  For I=1 To N
280  Z(I)=0
290    For J=1 To M
300      Z(I)=Z(I)+S(I,J)
310      Next J
320  Z(I)=Z(I)-F(I)
325  Print I,Z(I)
330  If Z(I)<=0 Then 360
340  D(I)=1
350  Print"PLANT ";I;" OPENED"
360  Next I
370  Rem CHECK IF ANY PLANTS HAVE BEEN OPENED
380  Rem OPEN THE ONE WITH LARGEST MINIMUM SAVINGS IF ONE
390  Rem HAS NOT BEEN OPENED.
400  K=1
410    For I=1 To N
420    If D(I)=1 Then 460
430    If Z(I)>Z(K) Then K=I
440    Next I
450  D(K)=1
452  Print"OPEN PLANT ";K
460  Rem STEP2 - CAN WE OPEN OR CLOSE ANY PLANT BASED ON
470  Rem MAXIMUM SAVINGS CRITERIA
472  Print
474  Print"MAX SAVINGS CRITERIA"
476  Print"PLANT","SAVINGS"
480    For I=1 To N
490    If D(I)<>0 Then 580
500      For J=1 To M
505      S1=100000000000.0
510        For K=1 To N
520        If D(K)<>1 Then 550
522        If C(I,J)>C(K,J) Then 570
```

Solving Plant/Warehouse Location Problems

Continued from page 125



Program listing

```
10  Input"HOW MANY PLANTS ARE BEING CONSIDERED ",N
20  Input"HOW MANY WAREHOUSES ARE THERE ",M
```

```
 30   Dim F(N),C(N,M),D(N),S(N,M)
 35     For I=1 To N
 40     Print"FIXED COST FOR PLANT ";I;"=";
 50     Input F(I)
 60     Next I
 70   Print"ENTER TRANSPORTATION COSTS ONE AT A TIME"
 80     For I=1 To N
 90       For K=1 To M
100       Print"PLANT ";I;" TO WAREHOUSE ";K;" = ";
110       Input C(I,K)
120       Next K
130     Next I
140   Rem STEP 1 - CAN ANY PLANTS BE OPENED BASED ON
150   Rem MINIMUM SAVINGS CRITERIA
160     For I=1 To M
165     Rem FIND MIN
167     T=0
169     Cost=100000000000.0
173       For K=1 To N
175       If C(K,I)>Cost Then 181
177       Cost=C(K,I)
179       Key=K
181       Next K
183       For K=1 To N
185       If K=Key Then 193
187       If S(Key,I)=0 Then S(Key,I)=100000000000.0
189       If S(Key,I)<C(K,I)-C(Key,I) Then 193
191       S(Key,I)=C(K,I)-C(Key,I)
193       Next K
200     Next I
260   Rem OPEN PLANTS WITH POSITIVE S(I)
267   Print"MIN SAVINGS CRITERIA"
268   Print"PLANT","SAVINGS"
530         If C(K,J)-C(I,J)>S1 Then 550
540         S1=C(K,J)-C(I,J)
550         Next K
560       S(I,J)=S1
570       Next J
580     Next I
590   T=0
600     For I=1 To N
605     If D(I)<>0 Then 720
610     Z(I)=0
620       For J=1 To M
630       Z(I)=Z(I)+S(I,J)
640       Next J
650     Z(I)=Z(I)-F(I)
655     Print I,Z(I)
660     If Z(I)>=0 Then 690
670     D(I)=-1
680     Print"CLOSE PLANT ";I
685     Goto 720
690     If T=0 Then 700
695     If Z(I)<T Then 720
700     T=Z(I)
710     K=I
720     Next I
730   If T=0 Then 760
740   D(K)=1
750   Print"OPEN PLANT ";K
760   Rem CHECK IF EVERY PLANT HAS BEEN OPEN OR CLOSED
770     For I=1 To N
780     If D(I)=0 Then 460
790     Next I
800   Print"SOLUTION COMPLETE"
810   End
```

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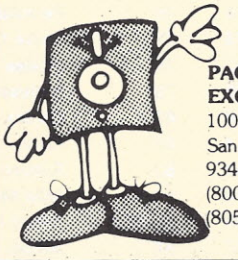

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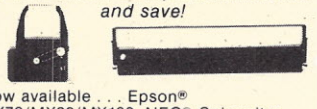

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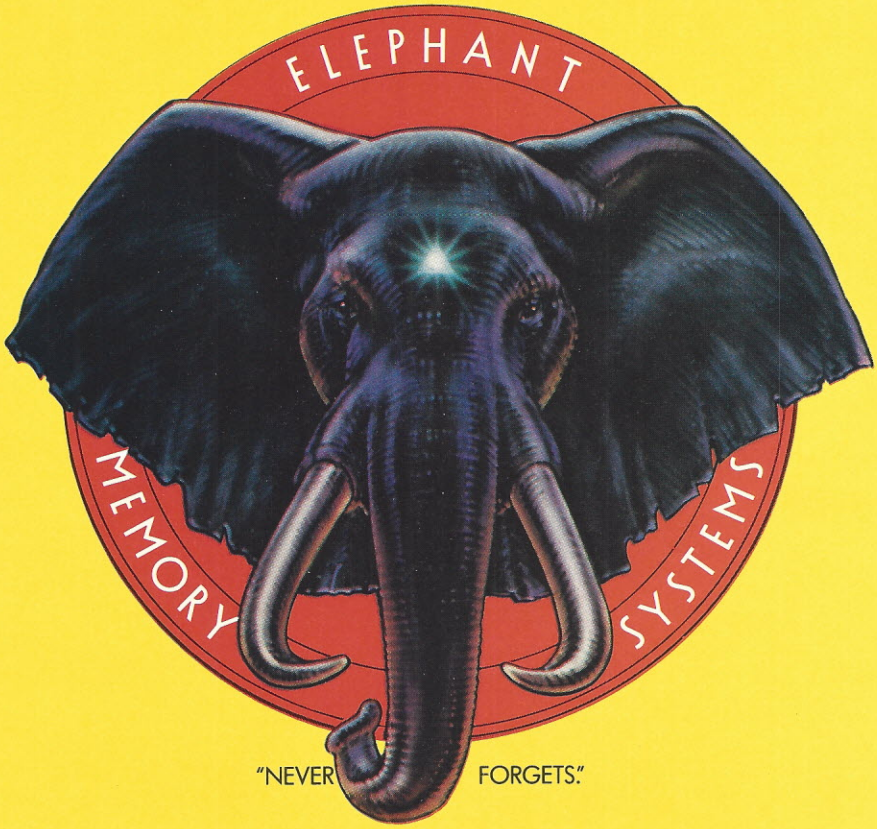

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